HABITAT USE, GROWTH, AND MORTALITY OF POST-SETTLEMENT LANE SNAPPER (*Lutjanus synagris*) ON NATURAL BANKS IN THE NORTHWESTERN GULF OF MEXICO

A Thesis

by

JOSEPH JOHN MIKULAS

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2007

Major Subject: Wildlife and Fisheries Sciences

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Approved by:

Chair of Committee,	Jay R. Rooker
Committee Members,	André M. Landry Jr.
	Timothy M. Dellapenna
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ABSTRACT

Habitat Use, Growth, and Mortality of Post-Settlement Lane Snapper (*Lutjanus synagris*) on Natural Banks in the Northwestern Gulf of Mexico. (May 2007)

Joseph John Mikulas, B.S., University of Vermont

Chair of Advisory Committee: Dr. Jay R. Rooker

Three low-relief banks (Heald Bank, Sabine Bank, Freeport Rocks) in the northwestern Gulf of Mexico were evaluated as lane snapper (*Lutjanus synagris* Linnaeus, 1758) nursery habitat. Trawl surveys were conducted in three habitat types (inshore mud, shell ridge, offshore mud), designated by side-scan sonar surveys, to determine patterns of distribution and abundance. Heald Bank and Sabine Bank were trawled in 2003 while Freeport Rocks was trawled in 2000 (Freeport A) and 2004 (Freeport B). Density of lane snapper was higher on Sabine Bank (20.8 ± 2.8 ind ha^{-1}) than on Heald Bank (1.1 ± 0.4 ind ha^{-1}), Freeport A (12.7 ± 2.3 ind ha^{-1}) or Freeport B (3.0 ± 1.0 ind ha^{-1}). Habitat-specific differences in density were observed, although patterns were not consistent among banks. Highest densities of lane snapper were found on Heald Bank's offshore habitat (1.7 ± 1.0 ind ha^{-1}), Sabine Bank's ridge habitat (26.5 ± 6.9 ind ha^{-1}), and on the inshore habitat of Freeport A and B (17.6 ± 4.9 ind ha^{-1} and 4.8 ± 3.6, respectively). Otolith microstructure analysis was performed on lane snapper collected in trawl surveys to determine age, hatch-date distribution, growth and mortality of new recruits. Hatch dates ranged from May 1 to August 31, peaking in June for Freeport (A and B) and in July for Heald Bank and Sabine Bank. Growth rates varied

from 0.90 mm d^{-1} at Heald Bank to 1.27 mm d^{-1} at Sabine Bank, and rates were highest on the ridge habitat of Sabine Bank (1.31 mm d^{-1}). Mortality of post-settlement lane snapper was higher on Sabine Bank (15.2% d^{-1}; $Z = 0.165$), than on Freeport A (9.2% d^{-1}; $Z = 0.097$), and was greatest on the ridge habitat of Sabine Bank (24 % d^{-1}; $Z = 0.275$). Recruitment potential ($G : Z$), evaluated on habitats at Sabine Bank, was highest on the offshore habitat, with a value greater than 1.0, indicating higher potential contribution to the adult population. Results indicate Heald Bank, Sabine Bank, and Freeport Rocks all serve as settlement habitat of lane snapper, which appear to be capable of successful settlement across a variety of habitats and banks.

DEDICATION

To my beloved family and friends

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INTRODUCTION

Adult lane snapper (*Lutjanus synagris* Linnaeus, 1758) range from North Carolina to southeastern Brazil (Randall, 1983) and occupy a wide variety of habitats. They have been found in turbid, clear, and brackish waters, and occur over artificial and natural reefs as well as soft bottom habitats (Randall, 1983; Bortone and Williams, 1986). Throughout their range, lane snapper are caught with various types of fishing gear (e.g. fish traps, hook and line, and spear guns; Bortone and Williams, 1986). Lane snapper are an important component of the recreational and commercial fisheries in the Caribbean, often accounting for a significant fraction of the overall commercial catch in countries such as Puerto Rico (Matos-Caraballo, 2000) and Cuba (Bustamante et al., 2000). To a lesser extent, lane snapper are caught in the Gulf of Mexico; 25.6 metric tons of lane snapper were commercially harvested from the Gulf in 2004 (NMFS FSED, Silver Spring, MD, pers. comm.). Despite their commercial and recreational importance, detailed life history data on lane snapper are limited, particularly for early life stages.

Reproductive behavior of adult lane snapper has been studied in the coastal waters of Bermuda (Luckhurst et al., 2000), Jamaica (Aiken, 2001), Puerto Rico (Figuerola et al., 1998), and Trinidad (Manickhand-Dass, 1987), but has not been extensively characterized within the Gulf of Mexico. Limited evidence suggests that this species is an aggregate spawner, similar to other congeners such as red snapper

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This thesis follows the style of the Bulletin of Marine Sciences.

(*Lutjanus campechanus* Poey, 1860) and gray snapper (*Lutjanus griseus* Linnaeus, 1758) (Allen, 1985; Grimes, 1987). Lane snapper spawning is protracted with peaks during spring or summer; however, periodicity and duration of spawning appear to vary by region (Manickchand-Dass, 1987; Acosta and Appeldoorn, 1992; Luckhurst et al., 2000; Aiken, 2001). Most spawning likely occurs within nearshore environments; larvae from SEAMAP ichthyoplankton surveys were most abundant on the continental shelf inside the 20 m depth contour (SEAMAP, unpublished data). In the Gulf of Mexico, densities of post-settlement individuals (approximately 30-40 days old) are highest in July and August, suggesting that the primary spawning period for these individuals extends from May to July (J. Rooker, pers. comm.).

Information on post-settlement lane snapper is limited, consisting of basic distribution data from broad-scale surveys (e.g. Bortone and Williams, 1986; Rooker and Dennis, 1991; Lindeman et al., 1998). These studies indicate that juvenile lane snapper use a variety of habitats (e.g. seagrass, mangrove prop roots, shell ridges, soft bottoms), including areas impacted by trawling activity (Gutherz and Pellegrin, 1988). Similar to that of red snapper, survival and recruitment success of lane snapper may be reduced due to incidental bycatch from shrimp fisheries, particularly in the Gulf (Gutherz and Pellegrin, 1988; Workman and Foster, 1994; Gillig et. al, 2001). While several studies have attempted to characterize nursery habitat of red snapper in the Gulf of Mexico (e.g. Gallaway and Cole, 1999; Workman et al., 2002; Rooker et al., 2004), comparable studies have not been conducted for lane snapper, thus limiting our ability to effectively characterize and protect nursery areas utilized by this species.

Data on red snapper provide a nice framework for lane snapper research since these two species employ similar spawning behaviors and often occupy the same habitats during early life. In the eastern Gulf, juvenile red snapper are most commonly observed on complex habitats such as natural banks, or low-profile reefs (e.g. shell hash) (Workman and Foster, 1994; Szedlmayer and Howe, 1997; Workman et al., 2002). In the northwestern Gulf, several low-relief banks (e.g. Heald Bank, Sabine Bank, Freeport Rocks) are prominent features on the inner continental shelf, and serve as post-settlement habitat of red snapper on these banks and adjacent, non-structured (i.e. mud bottom) habitats in close proximity to the bank (Rooker et al., 2004). While habitat complexity (i.e. refuge) typically reduces predation-mediated mortality (Rozas and Odum, 1988; Hixon and Beets, 1993), the relative importance of habitats on these natural banks is still undetermined for post-settlement red snapper as well as lane snapper. Since these natural banks appear to represent the only structured habitat on the inner shelf of the northwestern Gulf, there is a clear need to assess their potential value as nursery habitat.

This study evaluated the importance of natural banks and associated habitats in the northwestern Gulf of Mexico as nursery habitat of lane snapper. According to Beck et al. (2003), valuable nursery habitats "...contribute disproportionately to the size and numbers of adults relative to other...habitats". Following this definition, I attempted to predict the banks and habitats which would contribute most to the adult lane snapper population. To accomplish this goal, estimates of density, growth, and mortality were determined for post-settlement lane snapper collected from different natural banks

(Heald Bank, Sabine Bank, Freeport Rocks) and habitats (e.g. shell hash, sand, mud) within each bank. These measurements were used to determine the quality of different banks and habitats frequented by lane snapper in the northwestern Gulf.

Specific Objectives of this study:

1. Create habitat maps for Heald Bank, Sabine Bank, and Freeport Rocks using side-scan sonar

2. Quantify distribution and abundance of post-settlement lane snapper on banks and associated habitats

3. Determine the age, hatch-date, growth rate and natural mortality rate of post-settlement lane snapper

4. Assess the quality of different habitat types used by lane snapper during the early life interval using estimates of growth rate, mortality, and recruitment potential

METHODS

Field Work

The study area included three natural banks in the Gulf of Mexico: Heald Bank, Sabine Bank, and Freeport Rocks (Fig. 1). Heald Bank is located southwest of the Texas/ Louisiana border, approximately 71 km southwest of Sabine Pass, TX, and is oriented from northeast to southwest. The study area of Heald Bank was approximately 20 km^2 and ranged in depth from 9-14 m. Sabine Bank is located south of the Texas/ Louisiana border, approximately 39 km south of Sabine Pass, TX, and is oriented northeast to southwest. The study area of Sabine Bank was approximately 27 km^2 and ranged in depth from 8-11 m. Freeport Rocks is approximately 22 km south of Freeport, TX, and is oriented northeast to southwest. The area of Freeport Rocks covered in this study was approximately 80 km^2 and ranged in depth from 13-24 m.

Habitat maps were developed using an Edge Tech 272-TD dual frequency digital side-scan sonar, coupled with CODA data interpretation software. Signals are sent and received by dual transducers within the side-scan unit at a frequency of 100 kHz. Images are then created based upon the reflectivity (density) of bottom sediment. Dense substrates are highly reflective and are represented by lighter shades, while soft substrates have low reflectivity and are represented by darker areas (Fig. 2A, 2B, 2C). Recently, side-scan imagery has been successfully employed to identify habitat of snapper (Rooker et al., 2004; Patterson et al., 2005) and other marine teleosts (Franklin et al., 2003;

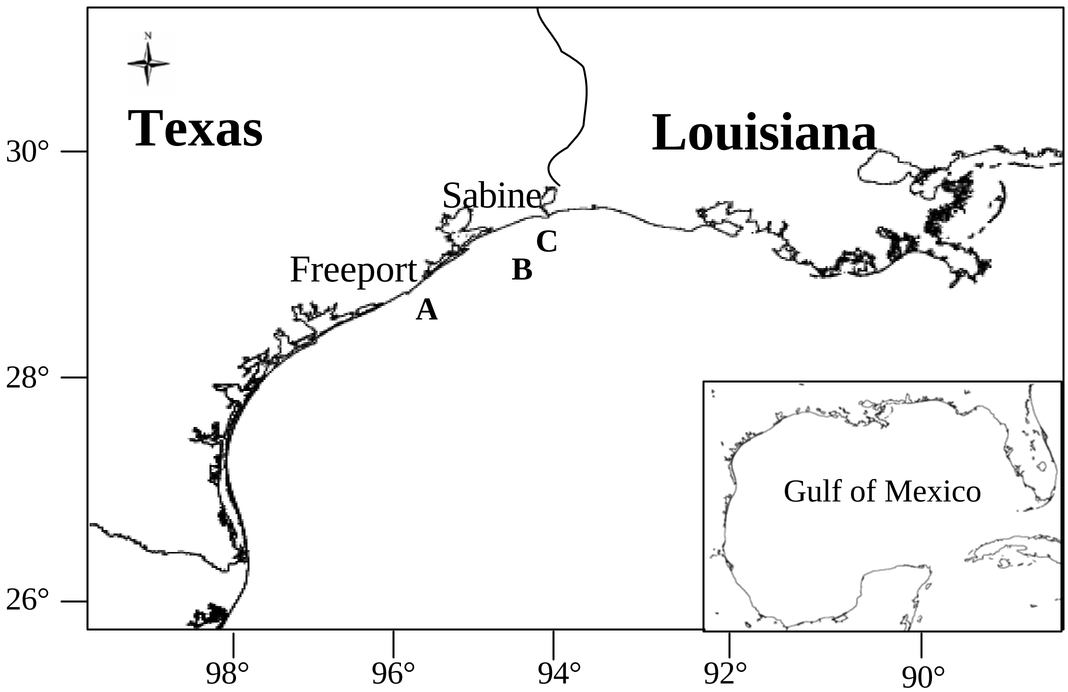

Figure 1. Study area in the northwestern Gulf of Mexico. Banks are represented by A (Freeport Rocks), B (Heald Bank), and C (Sabine Bank).

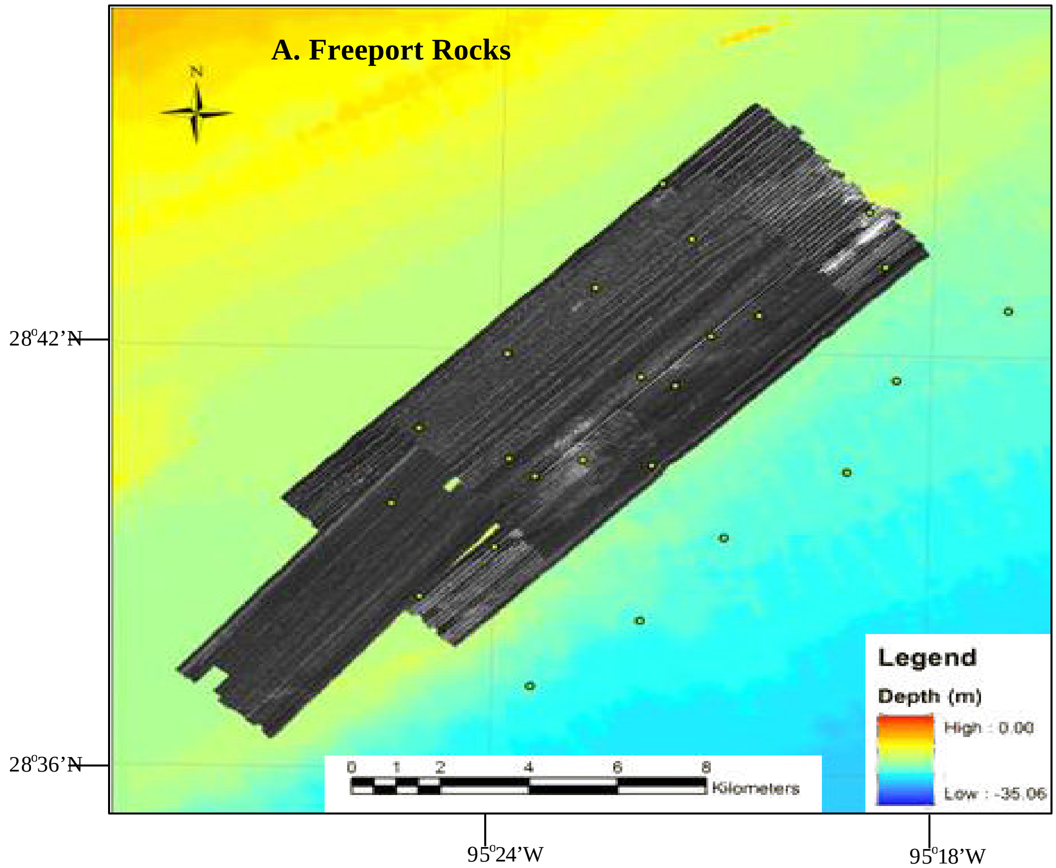

Figure 2A. Side-scan sonar mosaic of Freeport Rocks. Areas of high reflectivity (high density), such as hard packed sand and shell, are light in color, while areas of low reflectivity (low density), such as mud, are represented by dark regions. Side-scan sonar mosaics overlay bathymetry.

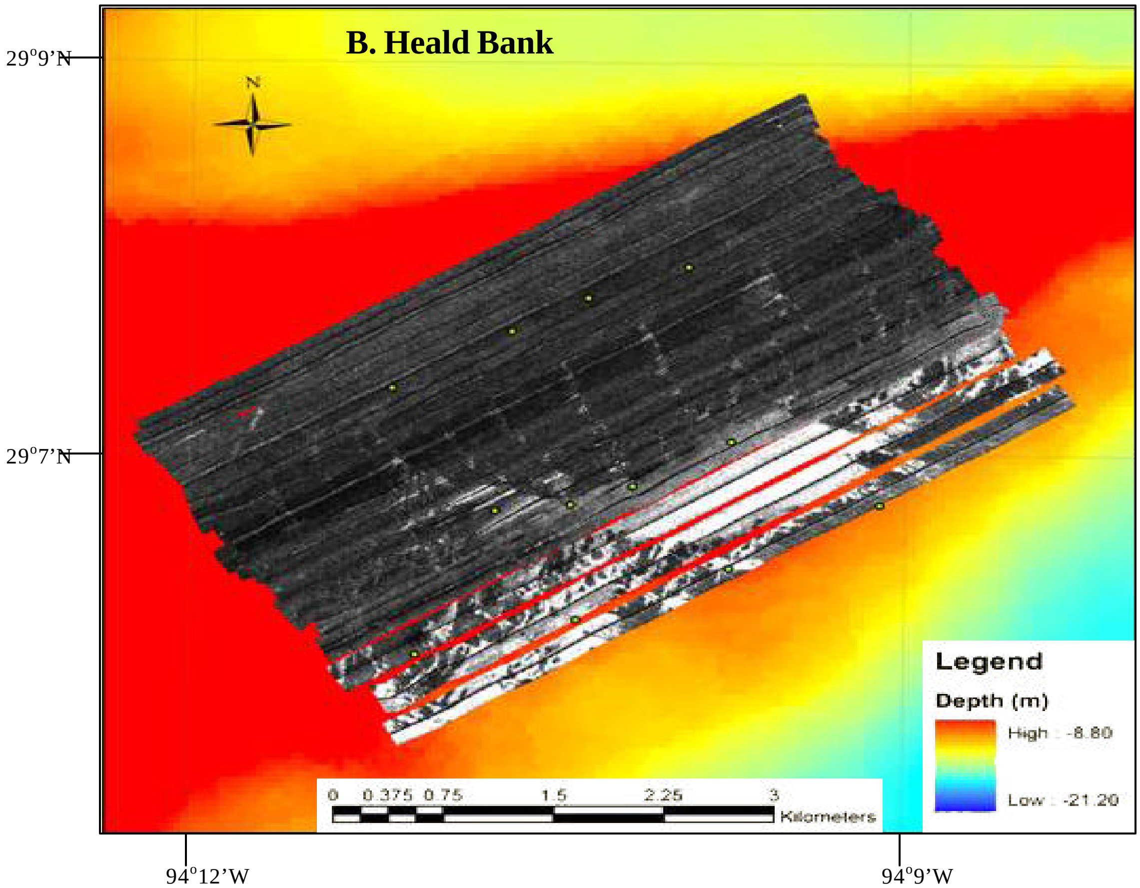

Figure 2B. Side-scan sonar mosaic of Heald Bank. Areas of high reflectivity (high density), such as hard packed sand and shell, are light in color, while areas of low reflectivity (low density), such as mud, are represented by dark regions. Side-scan sonar mosaics overlay bathymetry.

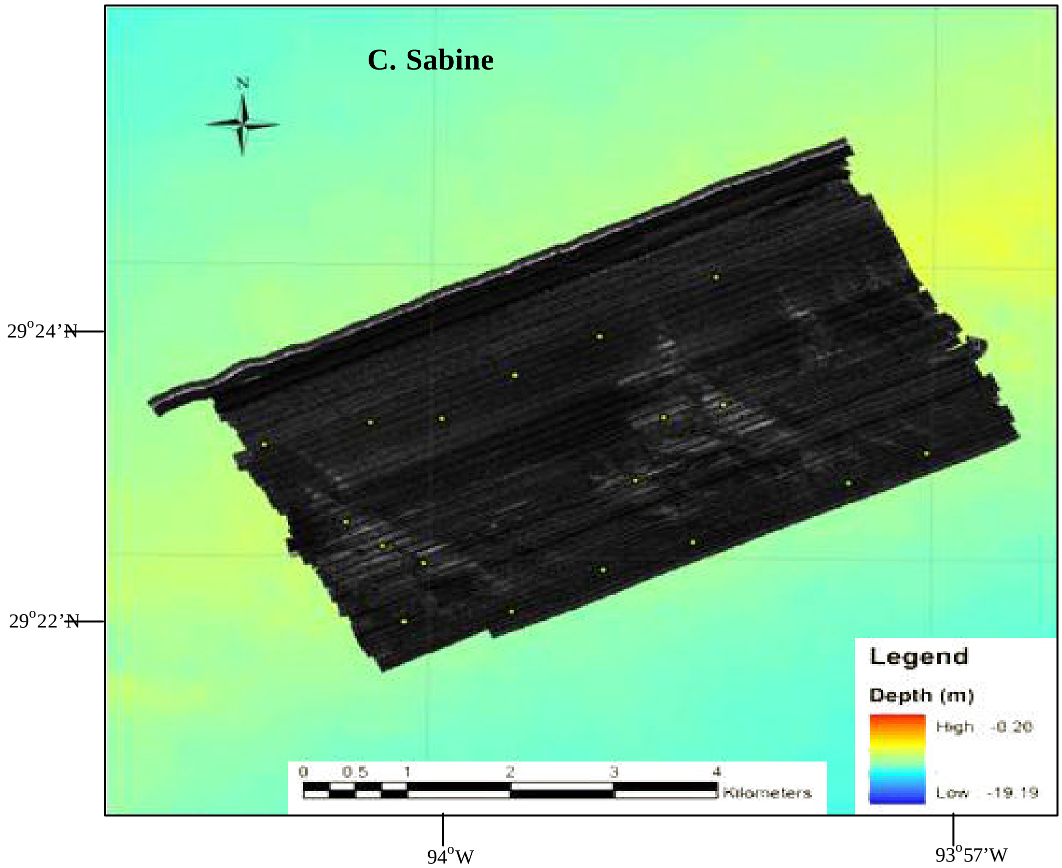

Figure 2C. Side-scan sonar mosaic of Sabine Bank. Areas of high reflectivity (high density), such as hard packed sand and shell, are light in color, while areas of low reflectivity (low density), such as mud, are represented by dark regions. Side-scan sonar mosaics overlay bathymetry

Jagielo et al., 2003). Interpreted side-scan sonar images, along with bathymetric data of the banks, allowed me to choose trawl sites representative of different bottom types. The side-scan unit was towed at 5 knots, swath width was 200 m (100 m on either side), and transects overlapped by 150%.

A ponar grab sampler was used to obtain bottom sediment samples, and carbonate analysis of bottom sediments was performed for ground truthing of bottom types. Sediment samples were washed through a 63 µm sieve, oven dried in a tin, and weighed. Ten percent HCl was then added to the samples until reaction with the carbonate stopped (as evidenced by the cessation of gas bubbles). The sample was then washed back through the sieve with deionized (DI) water, oven dried in a tin, and weighed again. The difference between the original sample weight and the acid-treated sample represented the amount of carbonate in the sediment.

Trawl sites were chosen within each habitat type (inshore mud, shell ridge, offshore mud) based upon side-scan imagery and bathymetric data. Initially, the ridge habitat of Freeport Rocks in a 2004 survey was further sub-divided into shell ridge and sand ridge habitats in order to assess small scale variation in habitat type. However, no significant difference was found between shell ridge and sand ridge habitats in terms of shell weight (P = 0.053, power = 0.494), so the data were combined into 1 habitat type (ridge) for this study. Twelve trawl sites were chosen for Heald Bank, with 4 inshore, 4 ridge, and 4 offshore sites. Eighteen trawl sites were chosen for Sabine Bank, with 6 inshore, 6 on the ridge area, and 6 offshore. Both Heald Bank and Sabine Bank were sampled in 2003. Freeport Rocks was sampled in two different years, 2000 and 2004.

Hereafter, Freeport Rocks 2000 and Freeport Rocks 2004 will be referred to as Freeport A and Freeport B, respectively. Eighteen sites were chosen for Freeport A (6 inshore, 6 ridge and 6 offshore), while twenty four sites were chosen for Freeport B (6 inshore, 12 ridge and 6 offshore). Post-settlement snapper were collected in bottom trawls from June through September to cover the anticipated peak recruitment period of red snapper (Futch and Bruger, 1976; Collins et al., 2000; Rooker et al., 2004) and lane snapper (J. Rooker, pers. comm.) in the Gulf of Mexico. Sampling trips to each bank lasted for two days at a time, and were conducted every 2-4 weeks. Trawl locations were recorded with GPS and tow direction was against prevailing surface currents. Trawling speed was 2.5 knots and lasted for 5 minutes on Heald Bank, Sabine Bank and Freeport B to ensure sampling occurred within the targeted habitat; trawls lasted for 10 minutes on Freeport A. A 6-m otter trawl, equipped with 2 cm mesh, a 1.25 cm mesh liner, and a 0.6 cm link tickler chain, and spread by 45 x 90 cm doors, was used to collect snapper. All snapper were immediately placed in a freezer for future processing. Bottom water conditions (i.e. temperature, salinity, dissolved oxygen) were recorded on-site with a Hydrolab Scout. Shell picked up in the trawl was weighed to the nearest 0.1 kg.

Laboratory Work

Prior to otolith extraction from each snapper, standard length (SL), fork length (FL), and total length (TL) were measured to the nearest 0.1mm. Statistical analysis was performed on SL and all results are reported in mm SL. Blotted weight was measured to the nearest 0.01 g. Sagittal otoliths were removed, cleaned, and processed based upon protocol developed by Stevenson and Campana (1992), and red snapper age and growth procedures of Rooker et al. (2004) were followed. One sagitta from each lane snapper was randomly selected for age determination and mounted in Struer's Resin (EPOES/EPOAR). Otoliths were sectioned along a transverse plane, adjacent to the core, using a Buehler Isomet low-speed saw. Sections were then fixed to microscope slides with Crystal Bond, sanded on Buehler Carbimet paper discs (240, 320, 400 and 600 grit) and polished with 0.3 µm alpha alumina micropolish on a microcloth following techniques reported by Rooker et al. (2004). Sectioned otoliths were examined through transmitted light on an Olympus BX41 compound microscope at 40X magnification. Image Pro Plus 4.5 image analysis software was employed to aid in counting growth increments. Distances (µm) from the core to the first visible ring were taken using the image analysis software.

Opaque bands of the sectioned otolith were considered daily growth increments (Panella, 1971) and counted along the sulcus, from the core to the edge in order to determine the age of an individual fish. In order to account for the difficulty in enumerating growth increments around the core, a correction factor was added to the increment count. This correction factor was based upon measurements from the core to the first visible ring in easy to read lane snapper otoliths and is represented by the equation:

(1) Correction Factor =

$$\text{Avg. Age} + ((\text{distance from core to first ring} - 1.76) / 1.54)$$

$r^2 = 0.900$, $n = 5$

Overall, the correction factor was only applied to 5 of 297 otoliths (1.7%). Ages were based upon the average of two counts for each otolith. In the event of a mean difference of counts greater than 10%, a third count was taken and used for age estimates. To complete the hatch-date distributions and age-frequency plots, ages were also predicted for individuals with unreadable otoliths, and for individuals not included in age determination. Equations predicting age of individuals were developed for each Bank:

(2) Heald Bank predicted age = 0.900(SL) – 5.188 $r^2 = 0.668$, $n = 11$

(3) Sabine Bank predicted age = 1.268(SL) – 16.901 $r^2 = 0.837$, $n = 247$

(4) Freeport A predicted age = 1.091(SL) – 9.214 $r^2 = 0.741$, $n = 15$

(5) Freeport B predicted age = 0.941(SL) – 7.755 $r^2 = 0.793$, $n = 24$

Of the 420 otoliths prepared, 297 (70%) were included in analyses. Fish greater than 60 mm SL were considered beyond the scope of the post-settlement period, and therefore were not included in age-based results (i.e. age-frequency, hatch-date distribution, growth). Number and percent lane snapper excluded from each bank were: Heald Bank, $n = 1$ (7.7%); Sabine Bank, $n = 63$ (17.4%); Freeport A, $n = 83$ (22.4%); Freeport B, $n = 9$ (13.2%). A sub-sample of lane snapper otoliths ($n = 46$) was independently aged by a second reader to provide quality control in aging technique. Reader agreement was high, based upon linear regression:

(6) Reader A age = 0.924 * Reader B age + 3.71 $r^2 = 0.975$

so no further age adjustments were made.

Otolith daily incremental formation was validated via alizarin complexone staining of lane snapper following the immersion methods of Thomas et al. (1995).

Wild lane snapper were captured from Freeport Rocks in August of 2005, held in a circular 0.58 m-diameter x 0.56 m-depth tank for 6 d, dipped in 100 mg L^{-1} alizarin complexone for 2 hr, and sacrificed 5, 10 and 15 d later. Otoliths were removed, processed, and analyzed for the number of growth increments after the alizarin complexone mark. On average, 5 (± 0.4), 9 (± 2.1), and 13 (± 2.7) increments were counted after the mark in fishes sacrificed 5, 10, and 15 d, respectively (Fig. 3). The following equation describes the relationship between expected number of increments after the mark and observed number of increments after the mark:

(7) Number of increments = 0.824 * (days after staining) + 0.759

$r^2 = 0.783$, $n = 23$

Linear regression was applied to otolith-based age information to determine growth rates and mortality. Daily growth rates were estimated using the linear growth equation:

(8) Standard Length = slope * age + y-intercept

Daily instantaneous growth was estimated using the exponential model:

(9) $L_t = L_o\, e^{gt}$

Where L_t represents length at time t (age in days), L_o represents the estimated length at time of hatching and g is the daily instantaneous growth coefficient. Linear and exponential growth estimation equations were comparable in terms of fitting the data, so linear growth estimates were used to more directly compare results to previous studies. In order to maintain growth rates representative of early life history, samples were restricted to lane snapper = 60mm SL.

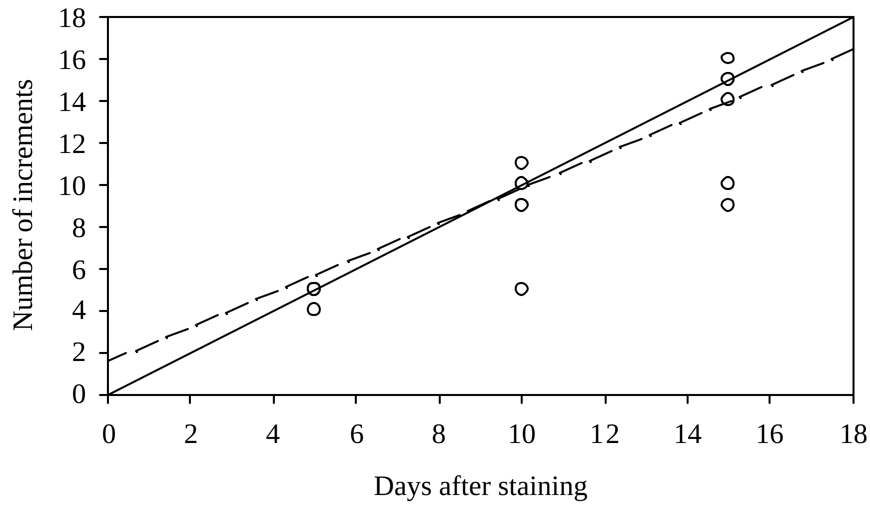

Figure 3. Number of daily increments on otoliths of post-settlement lane snapper observed after chemical marking with alizarin complexone. The solid line represents a 1:1 relationship, while the dashed line represents linear regression of observed number of increments on days after staining.

Weight-specific instantaneous growth coefficients were predicted using the exponential model:

(10) $W_t = W_o e^{-Gt}$

where W_t represents the wet weight (g) at time t (age in days), W_o represents estimated weight at time of hatching, *G* represents the weight-specific instantaneous growth coefficient (d^{-1}). Mortality of lane snapper was examined using the regression of Ln (abundance + 1) versus age (d) (i.e. catch curve). Instantaneous mortality rates were predicted using the exponential model:

(11) $N_t = N_o e^{-Zt}$

where N_t represents the abundance at time t (age in days), N_o represents abundance at time of hatching, *Z* represents the instantaneous mortality coefficient.

Recruitment potential, expressed as the ratio of weight-specific growth (*G*) to mortality (*Z*), was assessed for bank, habitat, and cohort on Sabine Bank and for bank on Freeport A. Any $G : Z$ value greater than 1 represents a group which is gaining in biomass, and therefore has a higher recruitment potential, while any $G : Z$ value less than 1 represents a group which is losing biomass, and therefore has a lower recruitment potential.

Data Analysis

Due to regional differences and possible inter-annual variability, statistical analyses were only performed within banks. Also, due to the small number of post-settlement lane snapper collected on Heald Bank ($n = 13$), statistical analysis was not performed on density, length, age, growth, or mortality data. Due to low sample size on

Freeport A (*n* = 15 otolith pairs) and Freeport B (*n* = 68 lane snapper), statistical analysis was not performed on growth data for Freeport Rocks A or B, or on mortality data for Freeport B. Sample size was too small (*n* = 59) on the inshore habitat of Sabine Bank to produce meaningful mortality data, so analysis was restricted to ridge and offshore habitats. Similarly, mortality could not be determined for Freeport A by habitat or cohort.

All statistical analyses were performed on SPSS 13.0, and significance was accepted at the a = 0.5 level. Percent carbonate and shell weight were analyzed across habitats, with a one way analysis of variance (ANOVA). Two-factor ANOVA was performed for all environmental parameters (temperature, salinity, DO), with date (expressed as the number of days since June 1) as a blocking factor. Two-factor ANOVA was also performed with density as a dependent variable, and date as a blocking factor. Many trawl sites and dates contained values of zero, so data were Ln + 1 transformed prior to analysis.

Analysis of covariance (ANCOVA) was employed to determine the effects of date and habitat on length, age, growth, and mortality, with date as the covariate for length and age and age as the covariate for growth and mortality. Additionally, ANCOVA was used to examine growth and mortality by cohort on Sabine Bank. Slopes of the catch curves were compared using an ANCOVA, with age as the covariate. The assumption of normality was tested with a Kilmogorov-Smirnov test, while the assumption of homogenous variances was examined with Levene's test and residual analysis. *Post hoc* differences among factor levels (a = 0.05) were examined with

Tukey's honestly significant difference (HSD) test when variances were equal, and with a Dunnett's T-3 test when variances were unequal. When a test failed to reject the null hypothesis, power analysis was performed.

RESULTS

Environmental Conditions

Water quality characteristics varied by bank, date, and habitat (Table 1, Fig. 4). Average water temperatures differed by only 0.8 ^{o}C among banks, and ranged from 28.5 ^{o}C to 29.2 ^{o}C. During the peak recruitment period of July to August, water temperatures increased for all banks, and date was identified as a significant factor affecting temperature for all banks ($P < 0.001$) (Fig. 5A, 5B). Mean water temperature was lowest in July (27.9 ± 0.3 ^{o}C), and increased in August (29.5 ± 0.1 ^{o}C). Differences in water temperature among habitats were also detected at Heald Bank ($P < 0.001$), Freeport A ($P = 0.024$), and Freeport B ($P < 0.001$). On all banks, mean water temperature was highest for the inshore (29.0 ± 0.2 ^{o}C) and ridge habitats (29.0 ± 0.1 ^{o}C), relative to the offshore (28.7 ± 0.3 ^{o}C) habitat. Tukey's HSD test indicated that water temperatures from both inshore (28.7 ^{o}C ± 0.3) and ridge habitats (28.7 ^{o}C ± 0.3) of Freeport A were significantly higher than the offshore habitat (28.1 ^{o}C ± 0.3). No significant difference in temperature by habitat was found at Sabine Bank ($P = 0.194$, power = 0.340).

Average salinities on Heald Bank (31.2 ± 0.5) and Sabine Bank (30.3 ± 0.6) were consistently lower than those of Freeport A (34.9 ± 0.1) and Freeport B (34.8 ± 0.2), indicating a stronger freshwater influence on the northernmost banks (Fig. 4). From July to August, salinity increased at Heald Bank (23.1 to 32.3) and Sabine Bank (26.7 to 32.0), stayed the same on Freeport A (34.9), and decreased on Freeport B (35.5 to 34.3) (Fig. 6A, 6B). Date was identified as a significant factor affecting salinity for all three banks ($P \leq 0.05$). Habitat was identified as a factor significantly influencing salinity on

Table 1. Summary of *P*-values from statistical analyses. Temperature, salinity, dissolved oxygen, shell weight, percent carbonate, and density were analyzed with an analysis of variance (ANOVA), while length, age, growth, and mortality were analyzed with an analysis of co-variance (ANCOVA). Due to low sample size (n = 59), mortality was not statistically analyzed for the inshore habitat of Sabine Bank.

	Heald 2003	**Sabine 2003**	**Freeport 2000**	**Freeport 2004**
Temperature				
Date	< 0.001	< 0.001	< 0.001	< 0.001
Habitat	< 0.001	NS	0.024	< 0.001
Salinity				
Date	< 0.001	< 0.001	NS	< 0.001
Habitat	0.015	0.006	NS	0.013
Dissolved Oxygen				
Date	< 0.001	< 0.001	NS	< 0.001
Habitat	0.031	0.009	0.004	NS
Shell Weight				
Habitat	< 0.001	< 0.001	< 0.001	< 0.001
Percent Carbonate				
Habitat	NS	0.024		
Density				
Date		0.018	0.002	NS
Habitat		0.020	0.031	NS
Length				
Habitat‡		< 0.001	NS	NS
Date†			< 0.001	0.034
Habitat†			< 0.001	0.018
Age				
Habitat‡		0.021	0.008	NS
Date†				0.069
Habitat†				0.006

† ANCOVA, y-intercepts test; ‡ ANCOVA, slopes test

Table 1 Continued.

	Heald 2003	**Sabine 2003**	**Freeport 2000**	**Freeport 2004**
Growth				
Cohort‡		0.048		
Cohort 1†		NS		
Cohort 2†		NS		
Habitat‡		NS		
Mortality				
Cohort‡		NS		
Habitat†		0.021		
Date†				

† ANCOVA, y-intercepts test; ‡ ANCOVA, slopes test

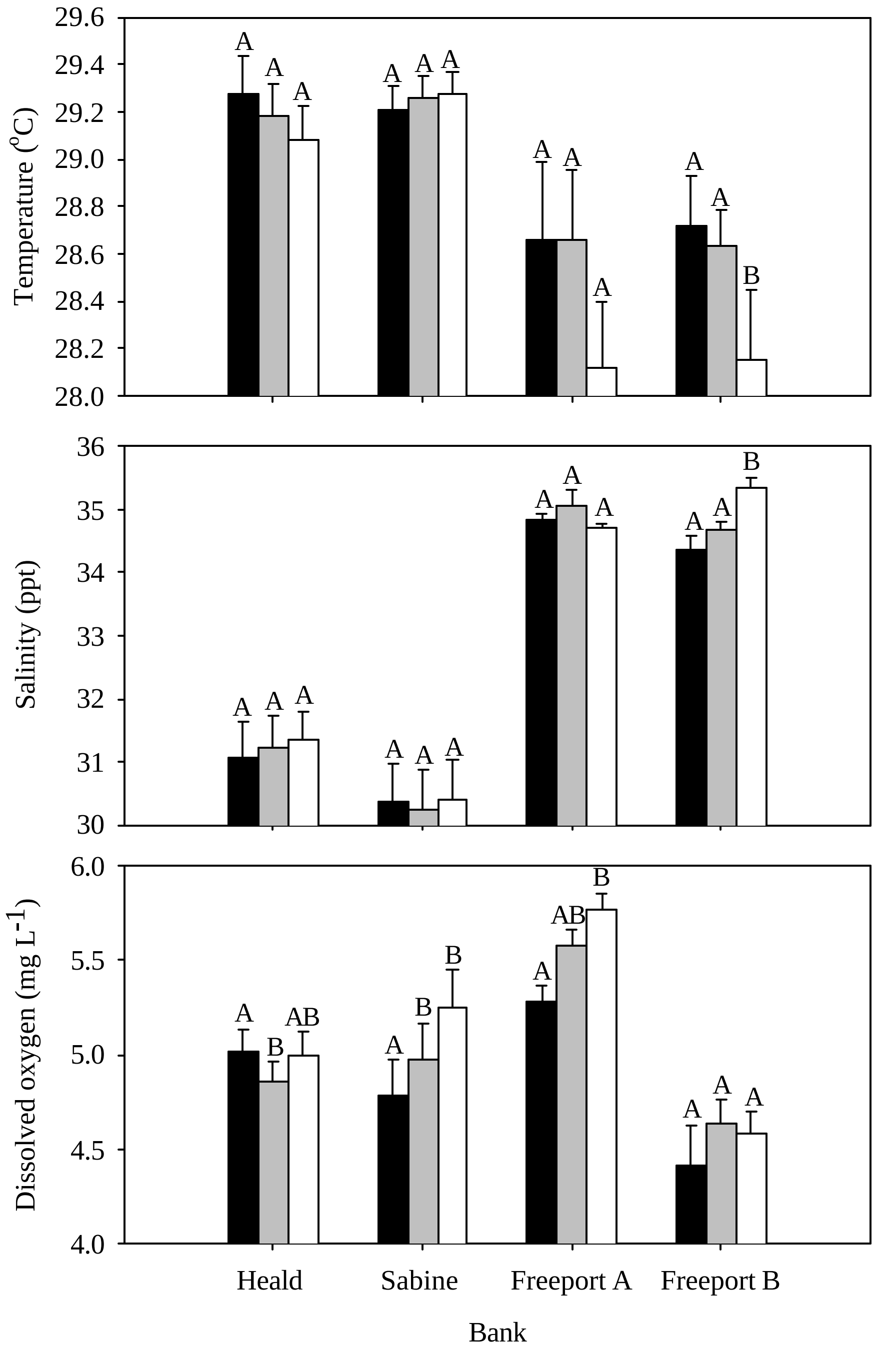

Figure 4. Environmental conditions (± 1 SE) on natural banks in the northwestern Gulf of Mexico: Heald Bank and Sabine Bank (2003), Freeport A (2000), and Freeport B (2004). Habitats are designated as inshore (¦), ridge (¦), and offshore (□). Factor levels with the same letters are not significantly different, based upon *a posteriori* comparisons, a = 0.05.

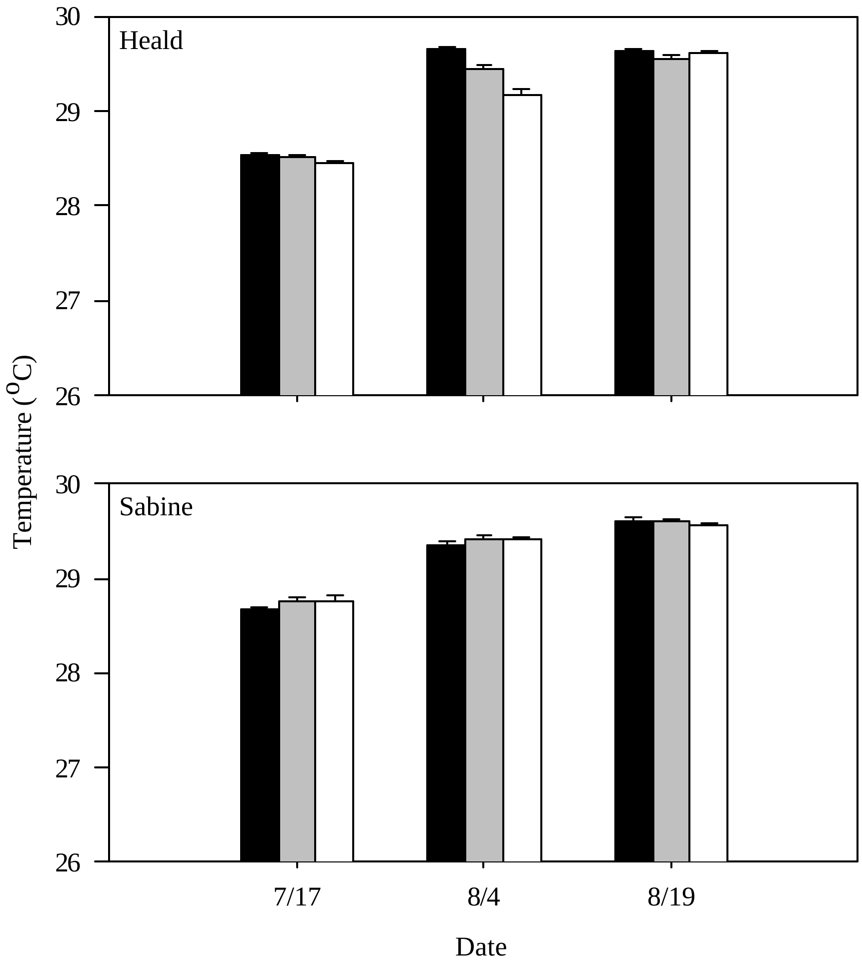

Figure 5A. Water temperature (± 1 SE) by date on Heald Bank and Sabine Bank (2003). Habitats are designated as inshore (¦), ridge (¦), and offshore (□).

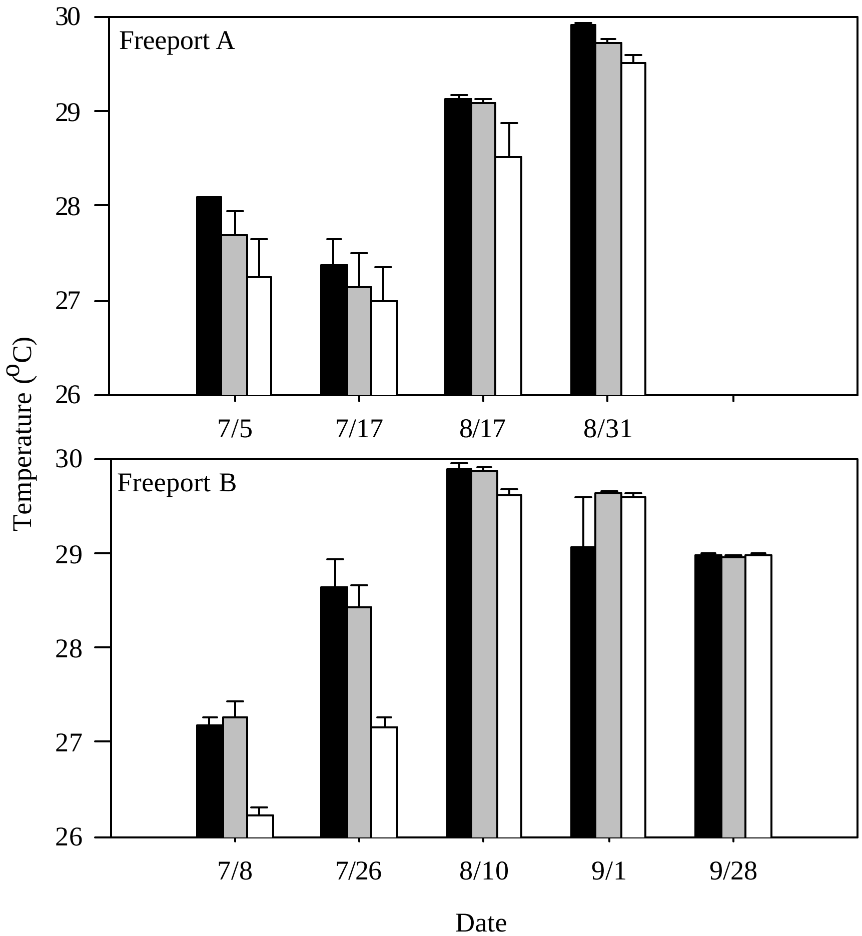

Figure 5B. Water temperature (± 1 SE) by date on Freeport A (2000), and Freeport B (2004). Habitats are designated as inshore (■), ridge (■), and offshore (□).

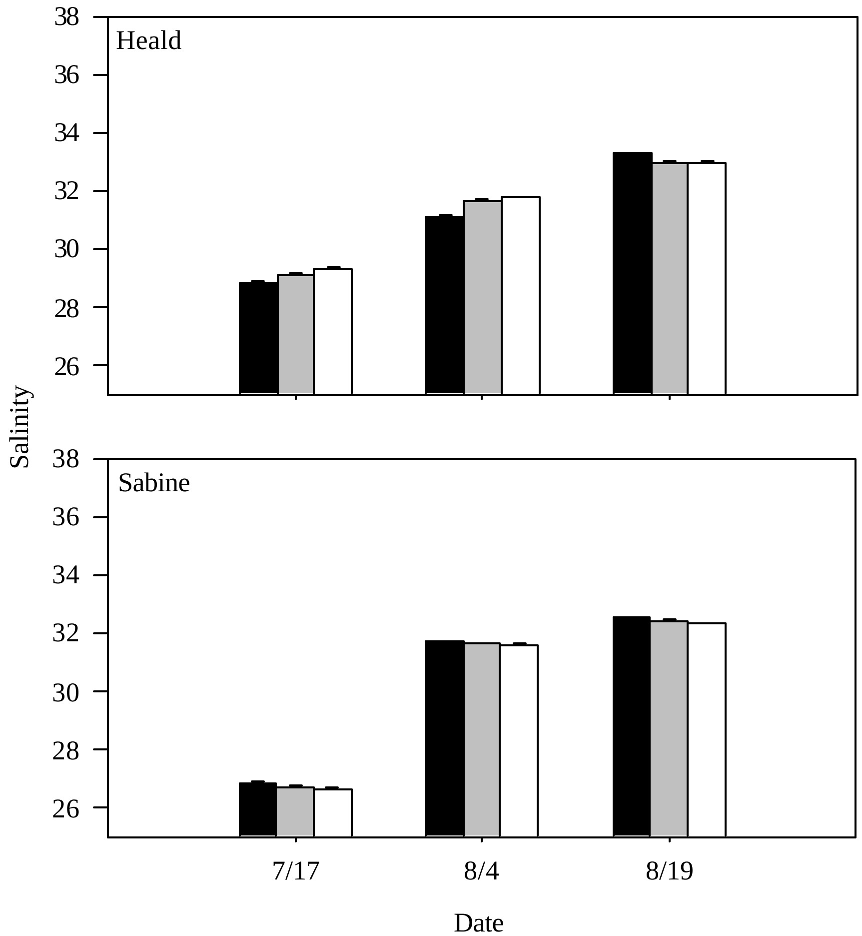

Figure 6A. Salinity levels (± 1 SE) by date on Heald Bank and Sabine Bank (2003), Freeport A (2000), and Freeport B (2004). Habitats are designated as inshore ( ), ridge ( ), and offshore (□).

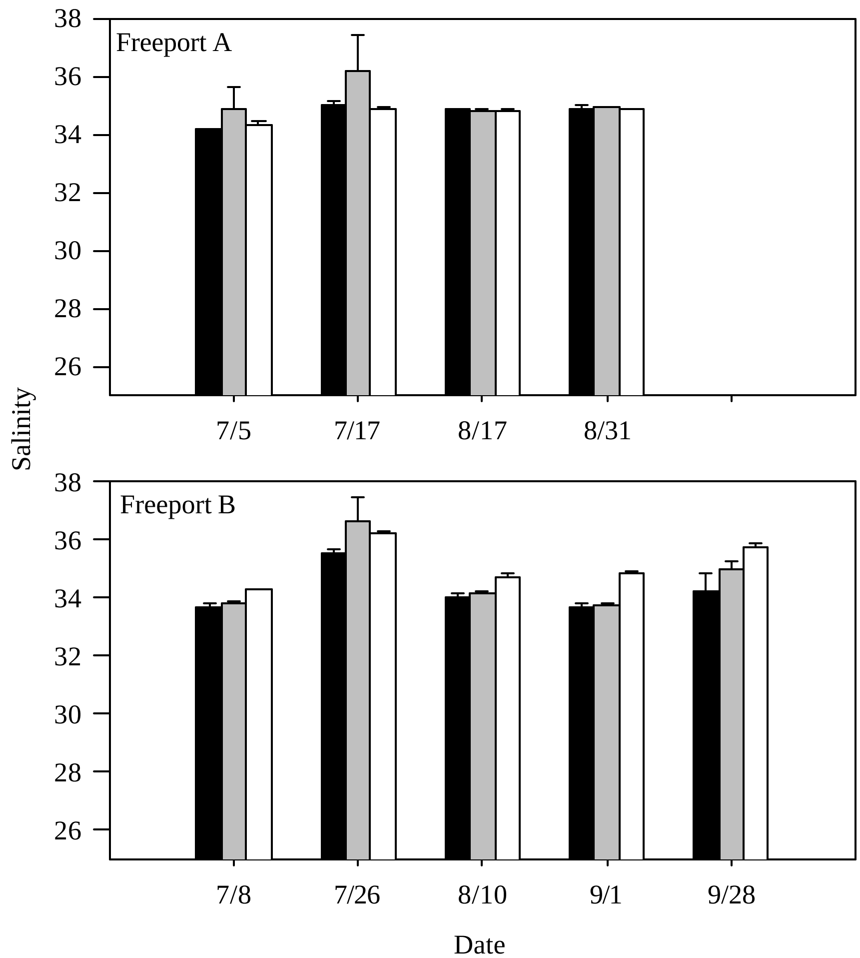

Figure 6B. Salinity levels (± 1 SE) by date on Freeport A (2000), and Freeport B (2004). Habitats are designated as inshore (¦), ridge (¦), and offshore (□).

Heald Bank (P = 0.015), Sabine Bank (P = 0.006), and Freeport B (P = 0.013). In general, salinity at the offshore habitat was 0.5 higher than the inshore or ridge habitats. Salinities did not differ among habitats at Freeport A (P = 0.130, power = 0.413).

Dissolved oxygen (DO) was relatively similar among banks: Heald (5.0 ± 0.1 mg L^{-1}), Sabine (5.0 ± 0.2 mg L^{-1}), Freeport A (5.5 ± 0.1 mg L^{-1}), and Freeport B (4.5 ± 0.2 mg L^{-1}) (Fig. 4). Seasonal variation in DO was detected at Heald Bank, Sabine Bank, and Freeport B ($P < 0.001$). From July to August, DO increased at Heald Bank (4.6 to 5.1 mg L^{-1}), Sabine Bank (4.5 to 5.3 mg L^{-1}), and Freeport B (4.5 to 5.3 mg L^{-1}) (Fig. 7A, 7B). Dissolved oxygen measurements were not taken during the July research cruise on Freeport A. Significant differences in DO by habitat were seen at all three locations: Heald Bank (P = 0.031), Sabine Bank (P = 0.009), and Freeport A (P = 0.004). On average, DO values were higher in the offshore habitats (5.2 ± 0.2 mg L^{-1S}) than ridge (5.0 ± 0.2 mg L^{-1}) or inshore (4.9 ± 0.2 mg L^{-1}) habitats. There was no significant difference in DO by habitat for Freeport B (P = 0.164, power= 0.376).

Shell material collected and carbonate sedimentary facies (expressed as kg ha^{-1} trawled and % CO_3, respectively) were also assessed on all banks (Table 1). There were marked differences in shell material from trawls among banks and collection years (Fig. 8). Heald Bank (25.2 ± 3.3 kg ha^{-1}), for example, yielded more shell material than Sabine Bank (10.8 ± 1.9 kg ha^{-1}), while Freeport A (30.6 ± 9.0 kg ha^{-1}) yielded over three times that of Freeport B (8.4 ± 1.7 kg ha^{-1}). Shell material in trawls varied significantly among habitats at each location, with the majority of the shell collected in trawls over ridge habitat: Heald Bank (33.3 ± 7.8 kg ha^{-1}), Sabine Bank (18.5 ± 3.5 kg

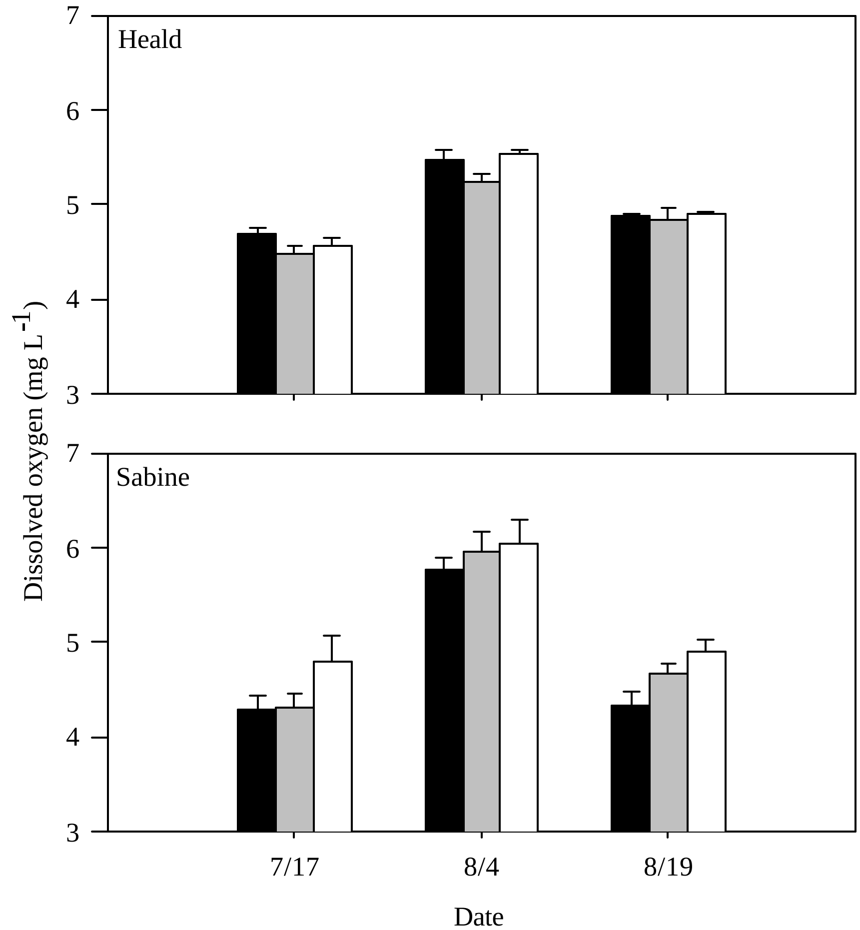

Figure 7A. Dissolved oxygen levels (± 1 SE) by date on Heald Bank and Sabine Bank (2003). Habitats are designated as inshore (¦), ridge (¦), and offshore (□).

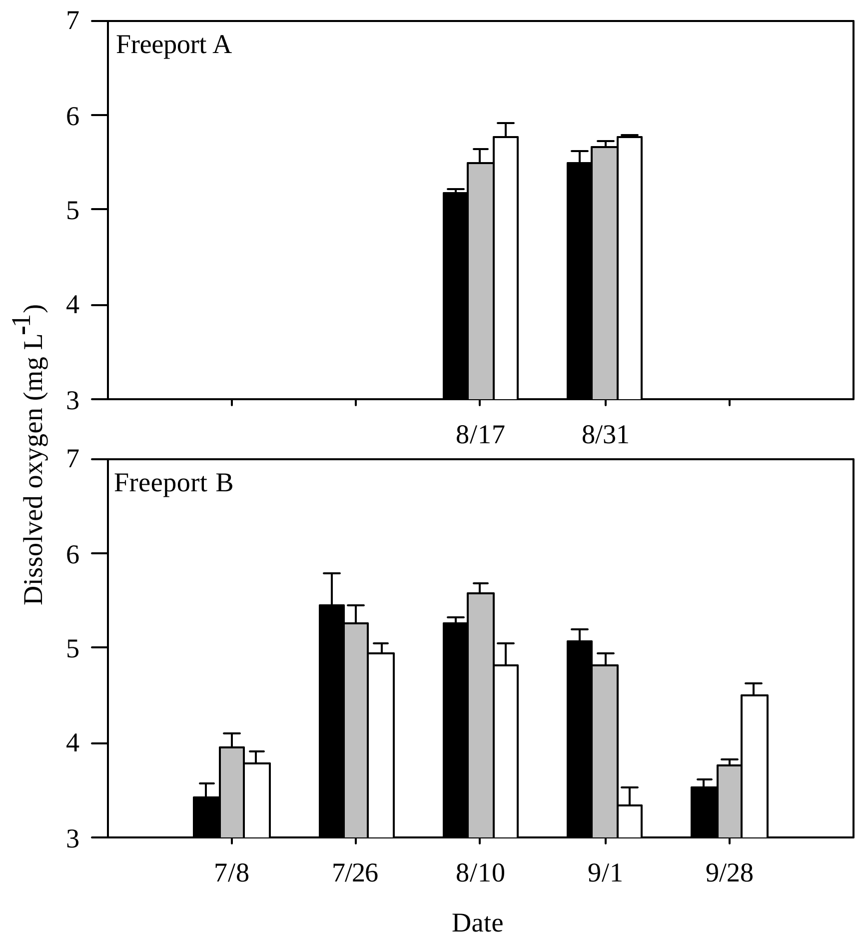

Figure 7B. Dissolved oxygen levels (± 1 SE) by date on Freeport A (2000), and Freeport B (2004). Habitats are designated as inshore (¦), ridge (¦), and offshore (□).

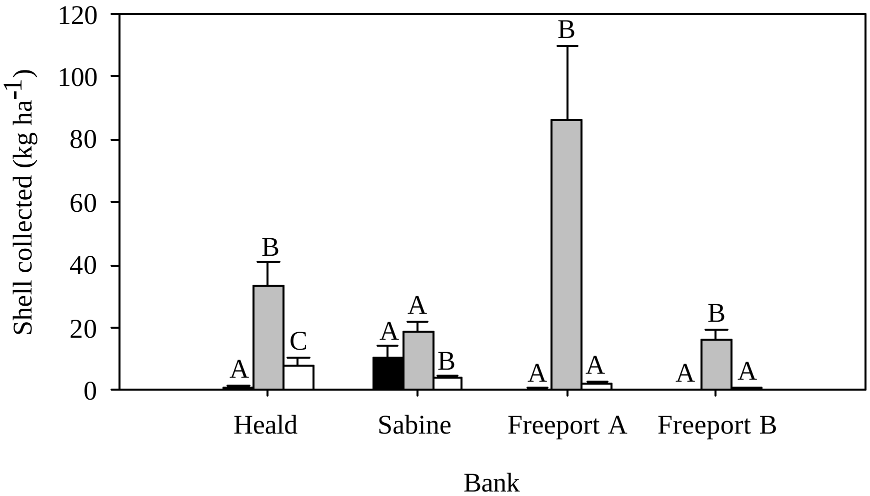

Figure 8. Mean shell weight (± 1 SE) collected in trawls on natural banks in the northwestern Gulf of Mexico: Heald Bank and Sabine Bank (2003), Freeport A (2000), and Freeport B (2004). Shell weight was recorded to confirm bottom types. Habitats are designated as inshore (¦), ridge (¦), and offshore (□). Factor levels with the same letters are not significantly different, based upon *a posteriori* comparisons, a = 0.05.

ha^{-1}), Freeport B (16.2 ± 3.1 kg ha^{-1}), and Freeport A (86.4 ± 23.7 kg ha^{-1}) (P <0.001 for all banks). In some cases, the inshore and offshore habitats had shell material, which were orders of magnitude less than that of the ridge habitat. Similarly, percent carbonate values in sediment cores were also highest on the ridge habitat at the two banks examined (Fig. 9). Heald Bank had an average of 55.8 ± 12.8% CO_3 on its ridge habitats, but the result was not statistically significant (P = 0.181, power = 0.320), while Sabine's ridge (28.2 ± 5.0 % CO_3) and offshore habitats (30.3 ± 23.3% CO_3) were significantly higher than the inshore habitat (6.3 ± 2.2% CO_3) (Dunnett's T-3 post hoc test, P = 0.003).

Abundance and Distribution

Overall, 813 post-settlement lane snapper were collected, and mean densities at Sabine Bank (20.8 ± 2.8 ind ha^{-1}) and Freeport A (12.7 ± 2.3 ind ha^{-1}) were at least fourfold higher than those on Heald Bank (1.1 ± 0. ind ha^{-1}) and Freeport B (3.0 ± 1. ind ha^{-1}) (Fig. 10). Densities varied as a function of both date and habitat at Sabine Bank (date P = 0.018, habitat P = 0.020) and Freeport A (date P = 0.002, habitat P = 0.031) (Table 1). Densities peaked during the August 4 sampling trip on Sabine (37.9 ± 10.5 ind ha^{-1}), and numbers were significantly higher on the ridge (26.5 ± 6.9 ind ha^{-1}) and offshore habitats (25.5 ± 3.4 ind ha^{-1}), relative to inshore habitats (10.3 ± 2.8 ind ha^{-1}) (Fig. 11A). On Freeport A, peak densities were significantly higher during the July 5 (17.8 ± 6.2 ind ha^{-1}) and July 17 (18.6 ± 5.6 ind ha^{-1}) sampling trips, and numbers were significantly higher inshore (17.6 ± 4.9 ind ha^{-1}) than offshore (5.2 ± 1.7 ind ha^{-1}) (Fig. 11B).

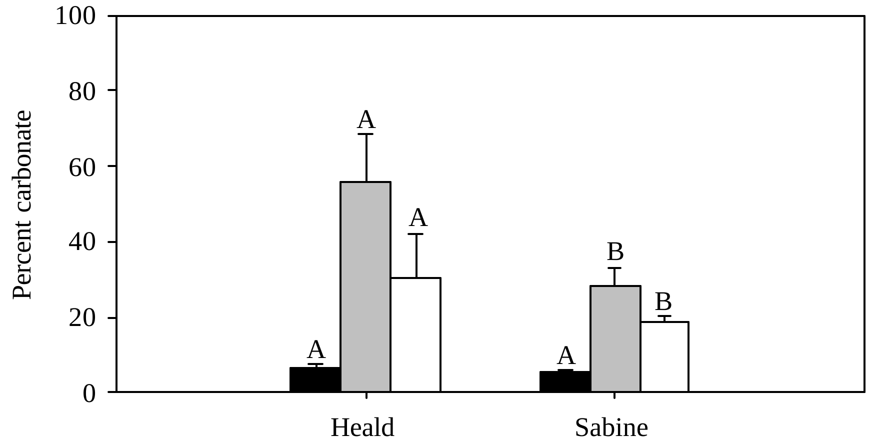

Figure 9. Mean percent carbonate (± 1 SE) of bottom sediment from Heald Bank and Sabine Bank (2003). Carbonate analysis was performed on different habitats to confirm bottom types. Habitats are designated as inshore (■), ridge (▒), and offshore (□). Factor levels with the same letters are not significantly different, based upon *a posteriori* comparisons, a = 0.05.

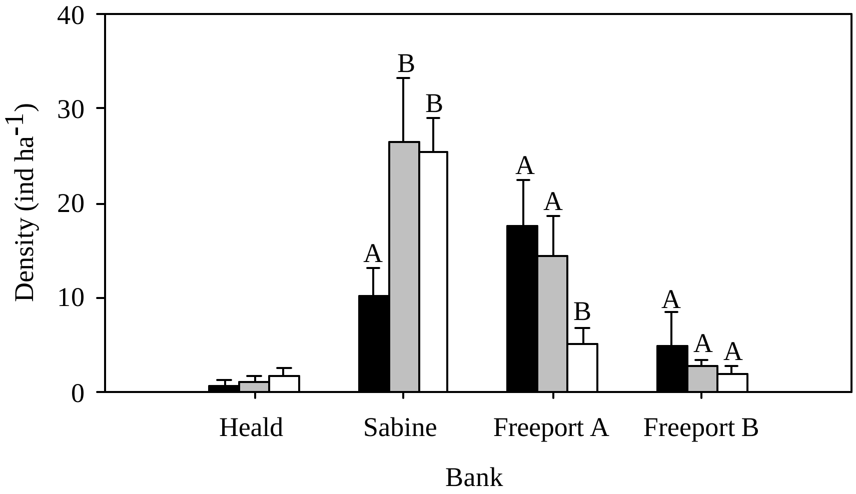

Figure 10. Mean densities (± 1 SE) of post-settlement lane snapper collected in trawls on natural banks in the northwestern Gulf of Mexico: Heald Bank and Sabine Bank (2003), Freeport A (2000), and Freeport B (2004). Habitats are designated as inshore (¦), ridge (¦), and offshore (□). Factor levels with the same letters are not significantly different, based upon *a posteriori* comparisons, a = 0.05.

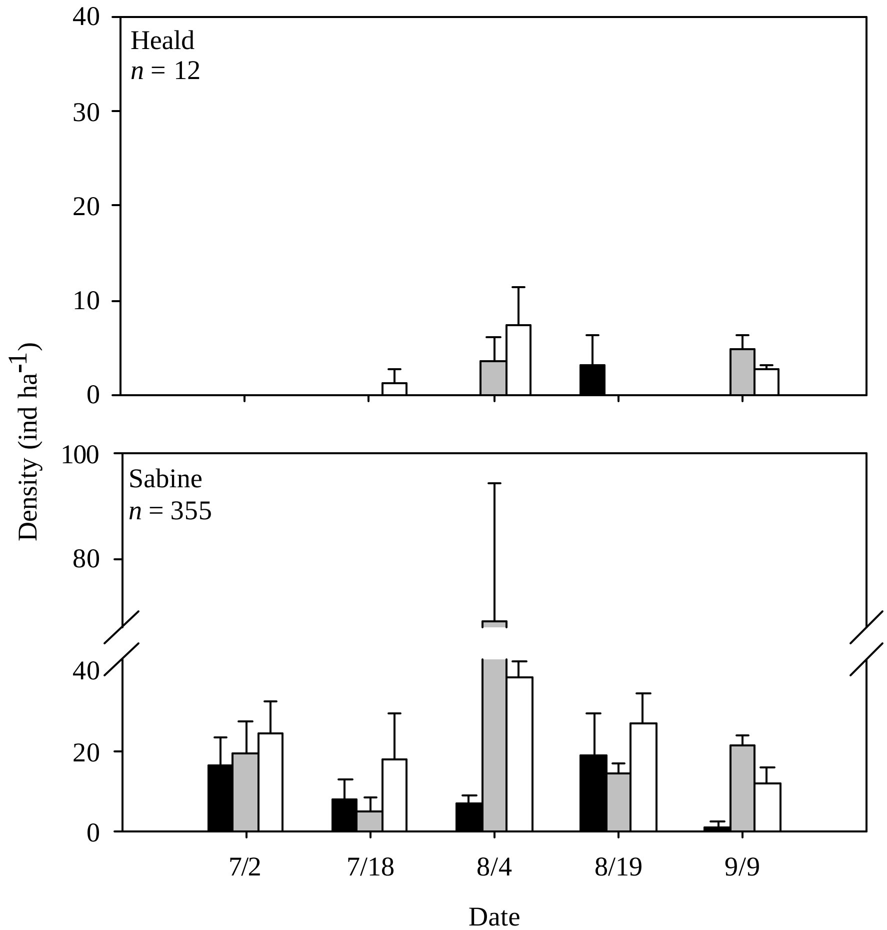

Figure 11A. Mean densities (± 1 SE) of post-settlement lane snapper collected in trawls on Heald Bank and Sabine Bank in 2003. Habitats are designated as inshore (¦), ridge (¦), and offshore (□).

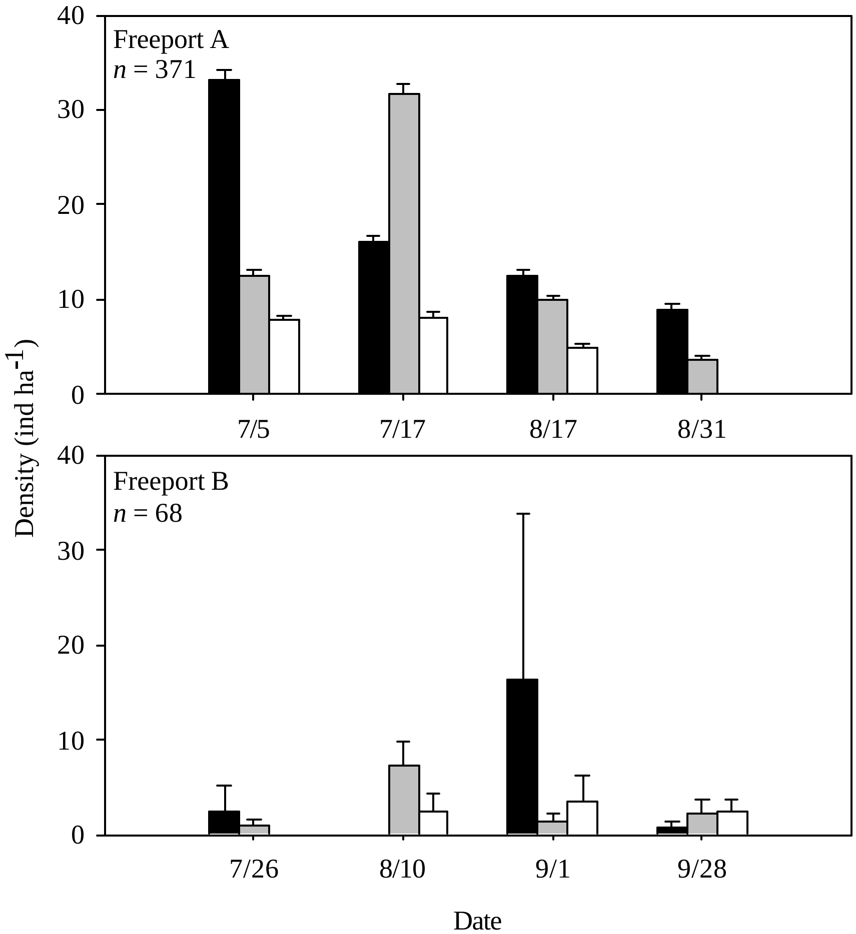

Figure 11B. Mean densities (± 1 SE) of post-settlement lane snapper collected in trawls on Freeport A (2000) and Freeport B (2004). Habitats are designated as inshore (¦), ridge (¦), and offshore (□).

Densities peaked during the August 10 (4.0 ± 1.1 ind ha^{-1}) and September 1 (6.2 ± 4.4 ind ha^{-1}) sampling trips on Freeport B, but no significant difference in date (P = 0.148, power= 0.515) or habitat (habitat P = 0.528, power = 0.155) was detected.

Size

Mean length of post-settlement lane snapper increased over the sampling season at all banks and size varied by habitat (Table 1, Fig. 12). Mean length of lane snapper at Freeport A and Freeport B (44.2 ± 1.2 mm and 43.1 ± 4.3, respectively) were substantially larger than lane snapper from either Heald Bank (28.0 ± 3.6 mm) or Sabine Bank (36.2 ± 1.0 mm). Still, the minimum length of new settlers present on each bank was relatively similar with individuals < 19 mm collected on all banks: Heald Bank (16.9 mm), Sabine Bank (15.1 mm), Freeport A (15.9 mm), Freeport B (18.1 mm). Mean length increased nearly threefold from July to September (21.6 to 67.0) at Sabine Bank (Fig. 13A). Date was identified as a factor significantly affecting mean length of lane snapper on Freeport A and Freeport B (ANCOVA, intercepts test, $P < 0.001$ and $P = 0.034$, respectively), with length doubling from July to August at Freeport A (28.2 to 74.7) and Freeport B (25.8 to 62.9) (Fig. 13B). In addition to date, mean length of post-settlement lane snapper varied as a function of habitat. Individuals found on the ridge habitat were significantly larger than those on the inshore or offshore habitats of Freeport A and Freeport B (ANCOVA, intercepts test, $P < 0.001$ and ANCOVA,

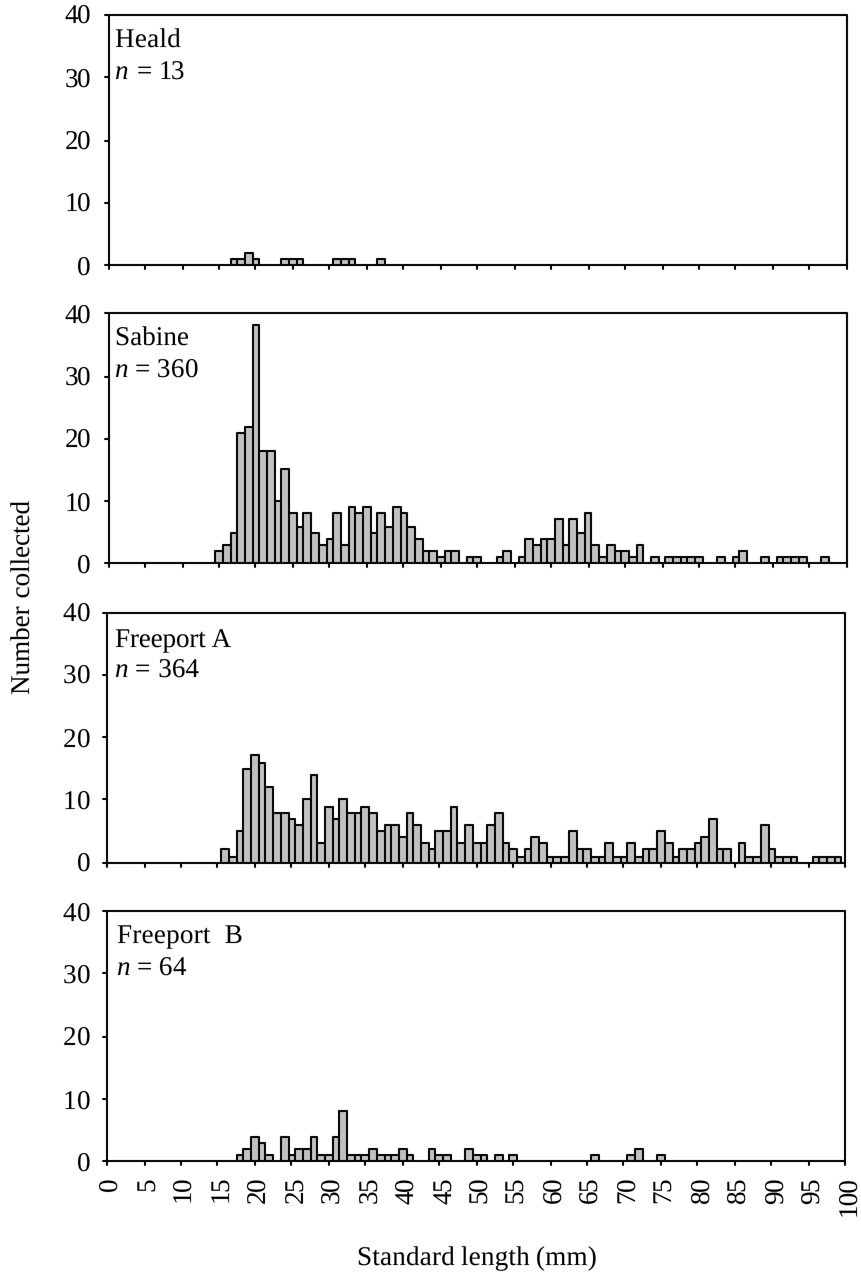

Figure 12. Length-frequency distributions of post-settlement lane snapper from Heald Bank and Sabine Bank (2003), Freeport A (2000), and Freeport B (2004). Twelve out of the 813 individuals collected (1.5%) were = 100 mm SL and not included.

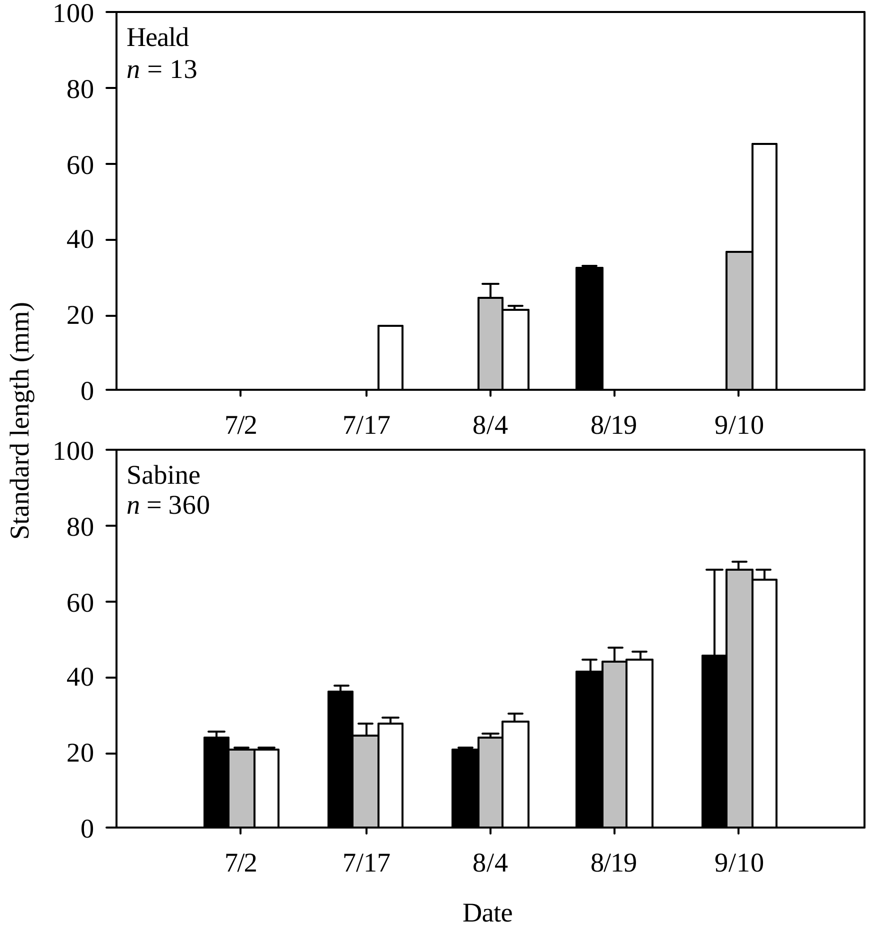

Figure 13A. Mean lengths (± 1 SE) of post-settlement lane snapper from Heald Bank and Sabine Bank (2003). Habitats are designated as inshore (¦), ridge (¦), and offshore (□). Two out of the 375 individuals collected (0.5%) were = 100 mm SL and not included.

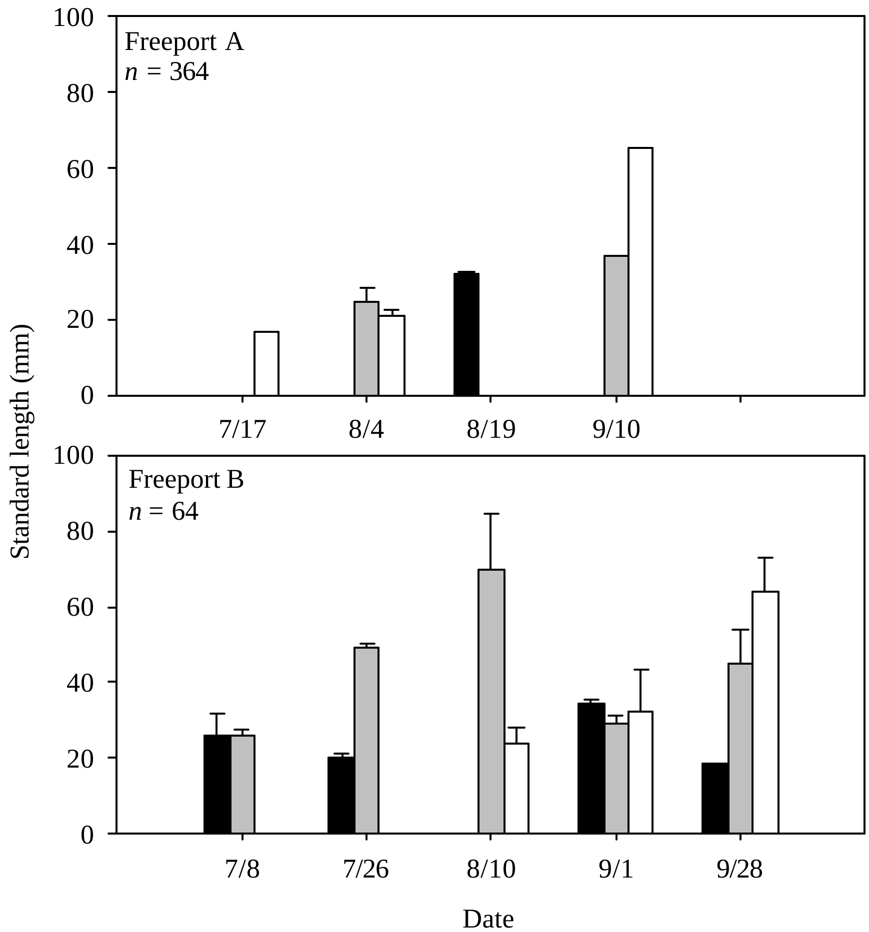

Figure 13B. Mean lengths (± 1 SE) of post-settlement lane snapper from Freeport A (2000) and Freeport B (2004). Ten out of the 438 individuals collected (2.3%) were = 100 mm SL and not included. Habitats are designated as inshore (¦), ridge (¦), and offshore (□).

intercepts test, P = 0.018, respectively). Similarly, the mean length of lane snapper at Sabine Bank was higher on the ridge habitat (37.3 ± 1.8 mm) than either the inshore (33.0 ± 1.8 mm) or offshore (36.4 ± 1.5 mm) habitats (Figure 14).

Age and Growth

Ages of post-settlement lane snapper collected at all banks ranged from 21 to 66 d, and individuals < 29 d old were collected from all banks (Fig. 15). The dominant age class of lane snapper was 30-39 d (peak at 27-28 d) for Heald Bank, Sabine Bank, and Freeport A. At Freeport B, most individuals were in the 30-39 d or 40-49 d age class (peak at 42 d). As expected, the oldest individuals were collected during trawl surveys at the end of the season at Heald Bank, Sabine Bank, and Freeport A; however, no temporal effect on age was detected at Freeport B (ANCOVA, intercepts test, P = 0.069, power = 0.446). A significant interaction between date and habitat on age was observed for Sabine Bank (ANCOVA, slopes test, P = 0.021) and Freeport A (ANCOVA, slopes test, P = 0.008) (Table 1). The mean age of lane snapper on the ridge habitat at both Freeport A and Freeport B (43.4 ± 0.9 d and 45.2 ± 1.9 d, respectively) was greater relative to inshore (35.5 ± 0.9 d and 40.9 ± 1.8 d, respectively) and offshore (40.9 ± 2.0 d and 35.3 ± 4.0 d, respectively) habitats.

Hatch dates of lane snapper ranged from early May to late August across all banks, and both bimodal and unimodal hatch-date distributions were observed (Fig. 16). The hatch-date distribution at Sabine Bank was bimodal, with peaks in early June and mid July. In contrast, Freeport A had a unimodal hatch-date distribution, with a single

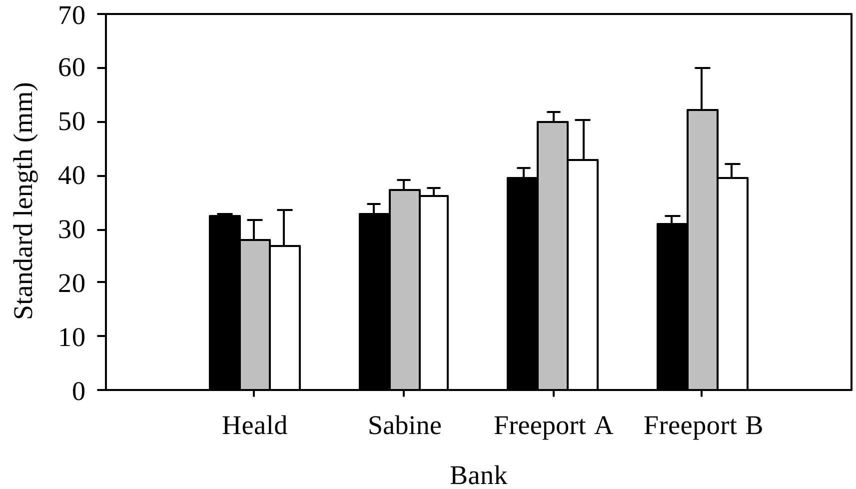

Figure 14. Mean lengths (± 1 SE) of post-settlement lane snapper collected in trawls on natural banks in the northwestern Gulf of Mexico: Heald Bank and Sabine Bank (2003), Freeport A (2000), and Freeport B (2004). Habitats are designated as inshore ( ), ridge ( ), and offshore (□).

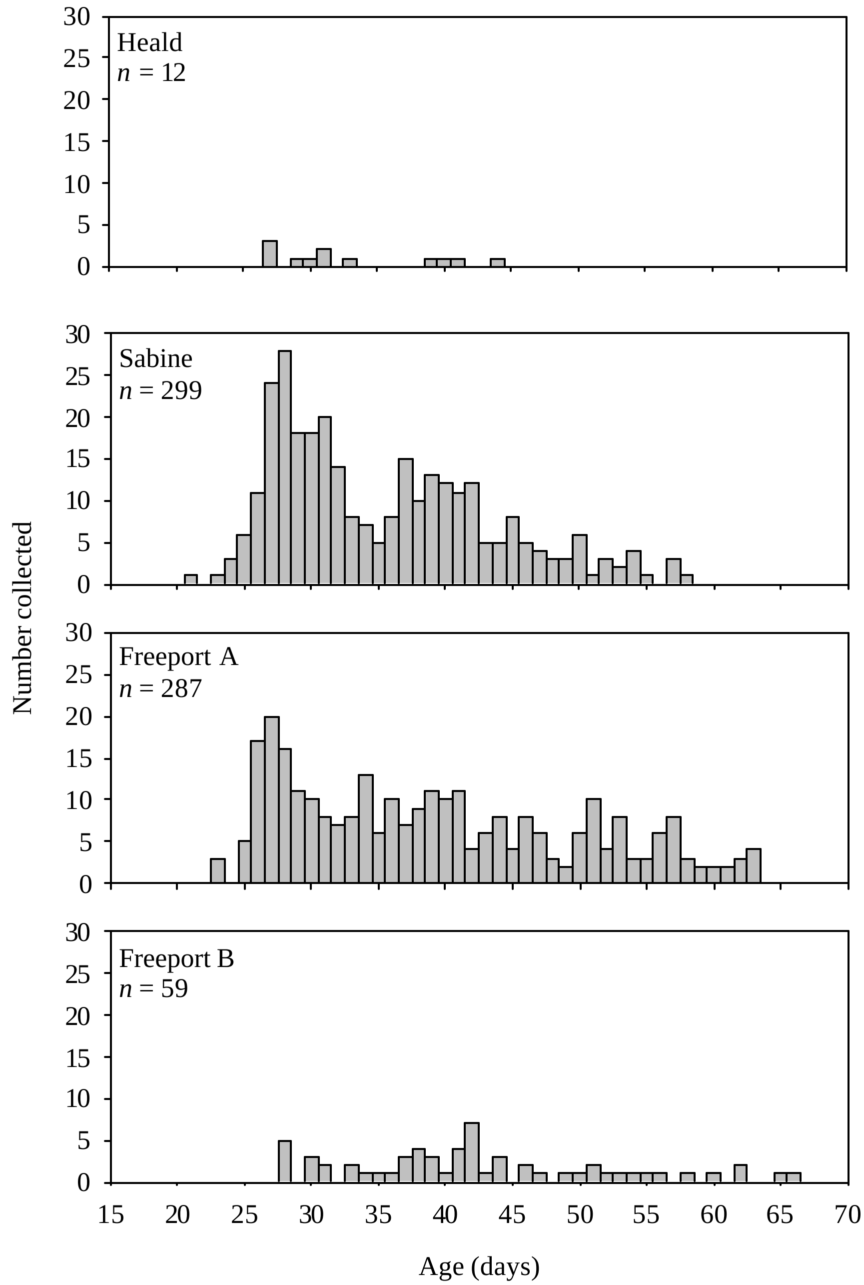

Figure 15. Age-frequency distributions of post-settlement lane snapper (= 60 mm SL) from Heald Bank and Sabine Bank (2003), Freeport A (2000), and Freeport B (2004).

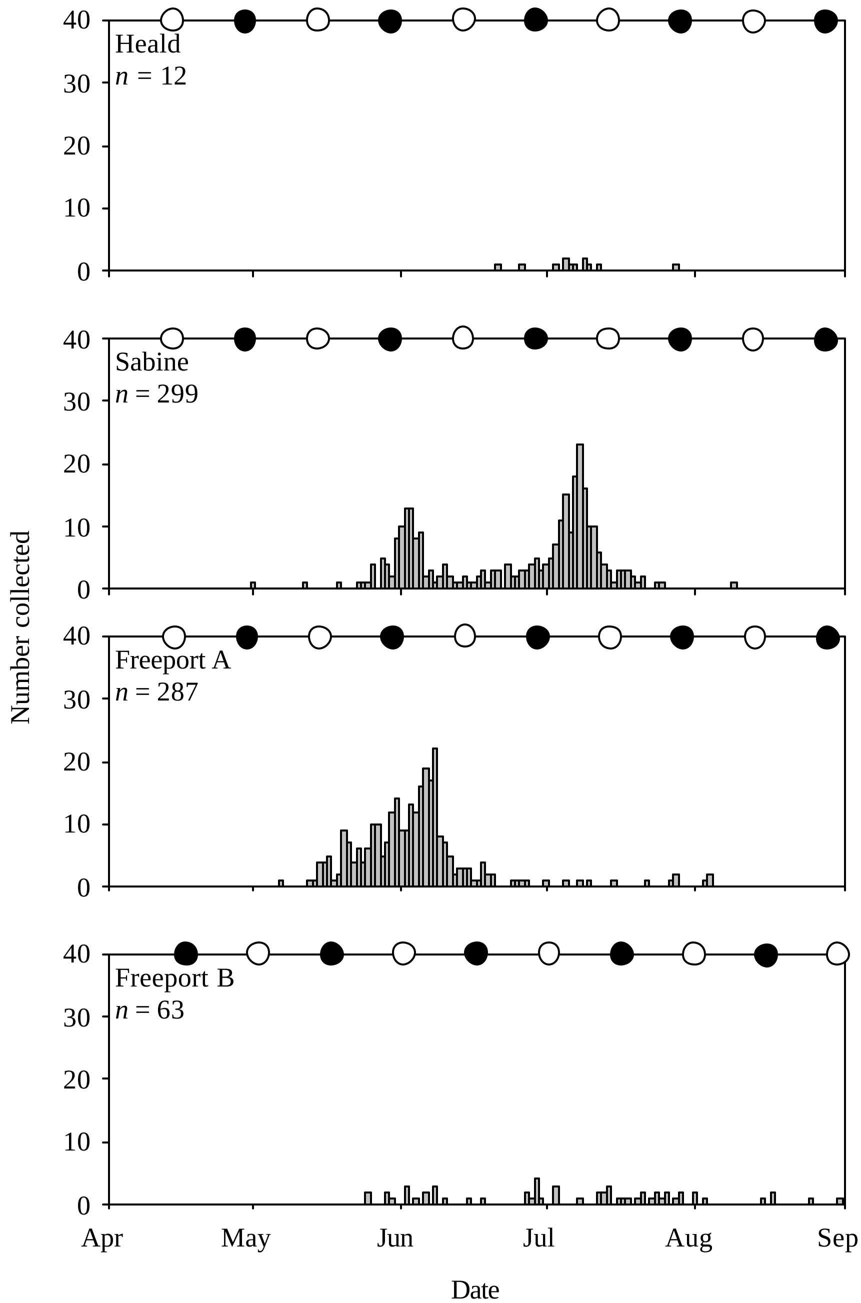

Figure 16. Hatch-date distributions of post-settlement lane snapper (= 60 mm SL) from Heald Bank and Sabine Bank (2003), Freeport A (2000), and Freeport B (2004). Full moon and new moon represented by ? and ?, respectively.

peak in early June. The majority of lane snapper from Freeport B (78%) were from June and July spawning events. While catch numbers were too low on Heald Bank to show any clear pattern, the majority of hatch dates were from July. The first peak in hatch dates of lane snapper on Sabine Bank occurred in early June and coincided with the new moon, while the second peak in hatch dates occurred in early July and coincided with the first quarter moon. Peak hatch date of lane snapper on Freeport A also coincided with the first quarter moon. Freeport B and Heald Bank had low catch numbers and patterns of hatch date with moon phase were not discerned.

Cohort- and habitat-specific variation in growth of post-settlement lane snapper were observed (Table 1). Growth rates were fairly similar among Heald Bank (0.9 mm d^{-1}), Sabine Bank (1. 3 mm d^{-1}), Freeport A (1.1 mm d^{-1}), and Freeport B (0.9 mm d^{-1}) (Figs. 17, 18). Using hatch-date distributions, two distinct cohorts (May 1- June 21 and June 23-July 31) were identified for Sabine Bank. The early season cohort growth rate (1.0 mm d^{-1}) at Sabine Bank was significantly lower (ANCOVA, slopes, P = 0.048) than the later season cohort (1.4 mm d^{-1}) (Fig. 19). Habitat-specific growth was determined for each cohort and no effect of habitat was detected for the early or late season cohorts on Sabine Bank (ANCOVA, slopes test, P = 0.206, power = 0.333 and ANCOVA, slopes test, P = 0.558, power = 0.146, respectively) (Fig. 20).

Mortality

Daily instantaneous mortality coefficients (Z d^{-1}) were estimated for lane snapper over 10-d intervals at Sabine Bank and Freeport A (Table 1, Fig. 21). Overall, Z estimates were higher on Sabine (Z = 0.165) than Freeport B (Z = 0.097) over similar

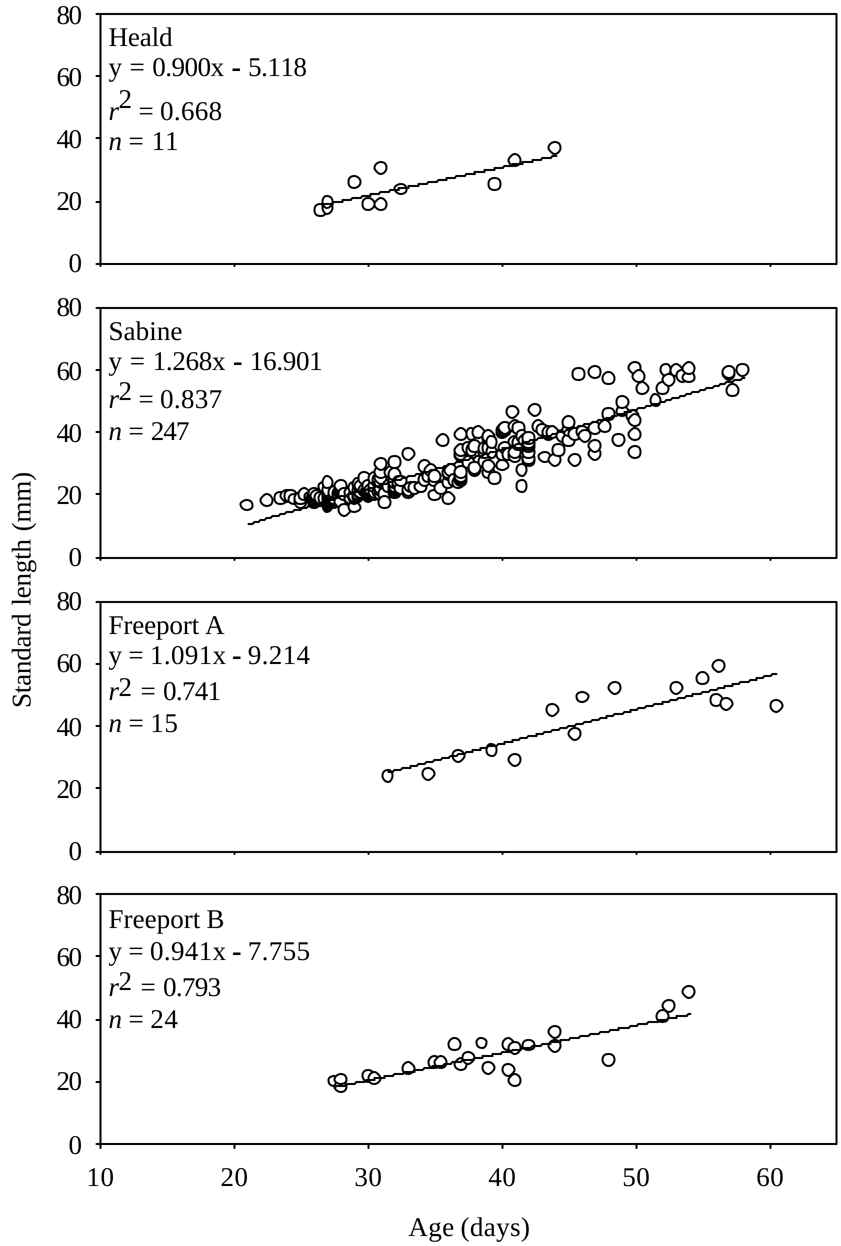

Figure 17. Size-at-age relationships by bank for post-settlement lane snapper (= 60 mm SL) from Heald Bank and Sabine Bank (2003), Freeport A (2000), and Freeport B (2004). Linear regression plots and equations included. Growth rate based on slope of regression equation.

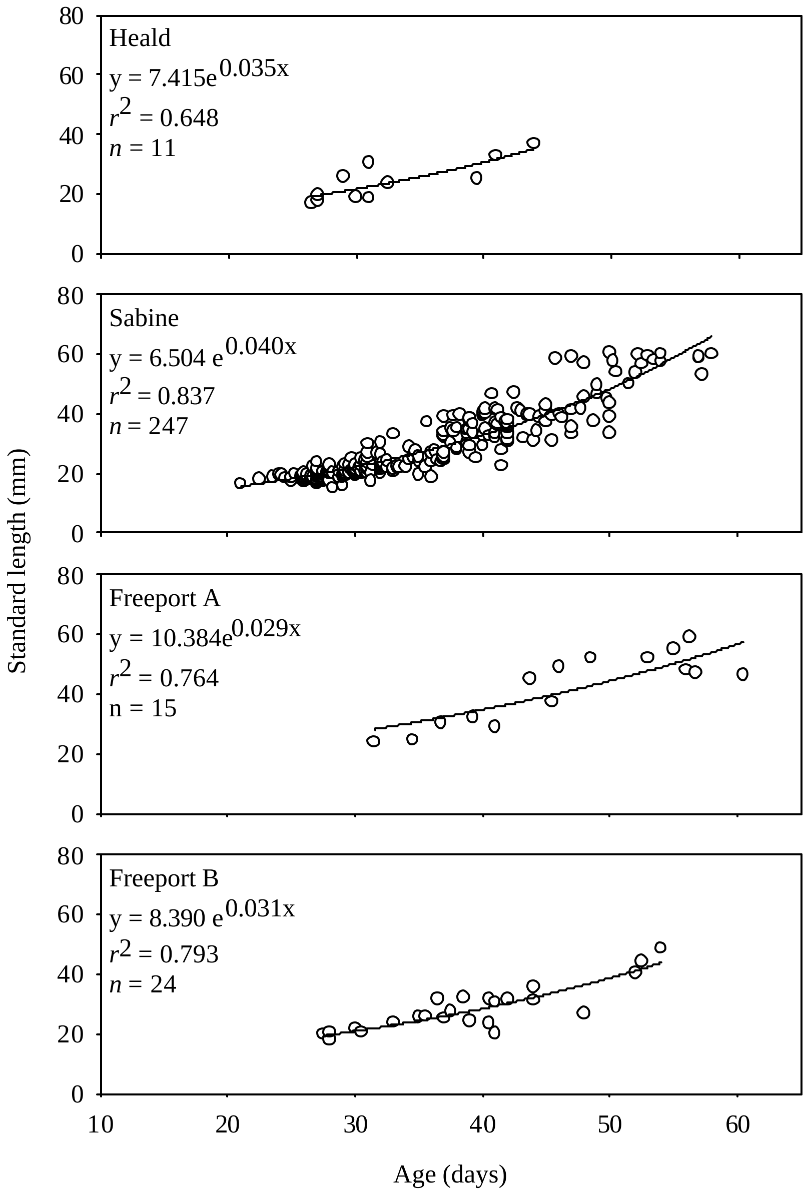

Figure 18. Size-at-age relationships by bank for post-settlement lane snapper (= 60 mm SL) from Heald Bank and Sabine Bank (2003), Freeport A (2000), and Freeport B (2004). Exponential regression plots and equations included. Growth rate based on slope of regression equation.

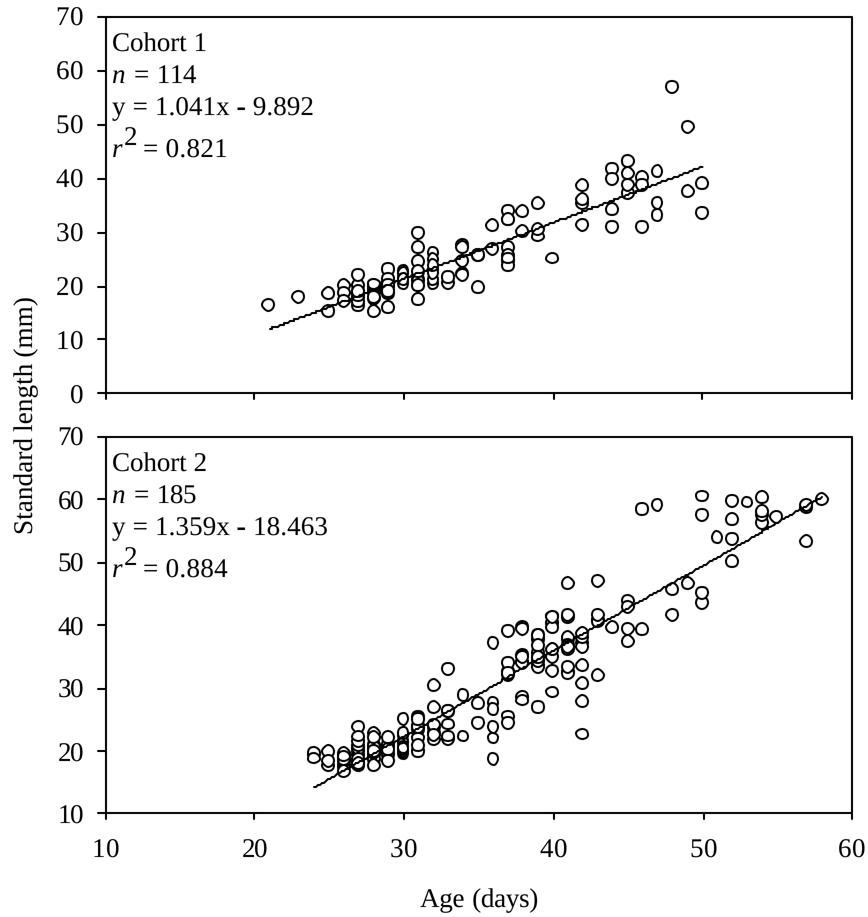

Figure 19. Size-at-age relationships by cohort for post-settlement lane snapper (= 60 mm SL) from Sabine Bank (2003). Cohort 1 is from May 1 - June 21 and cohort 2 is from June 23 – July 31. Linear regression plots and equations included. Growth rate based on slope of regression equation.

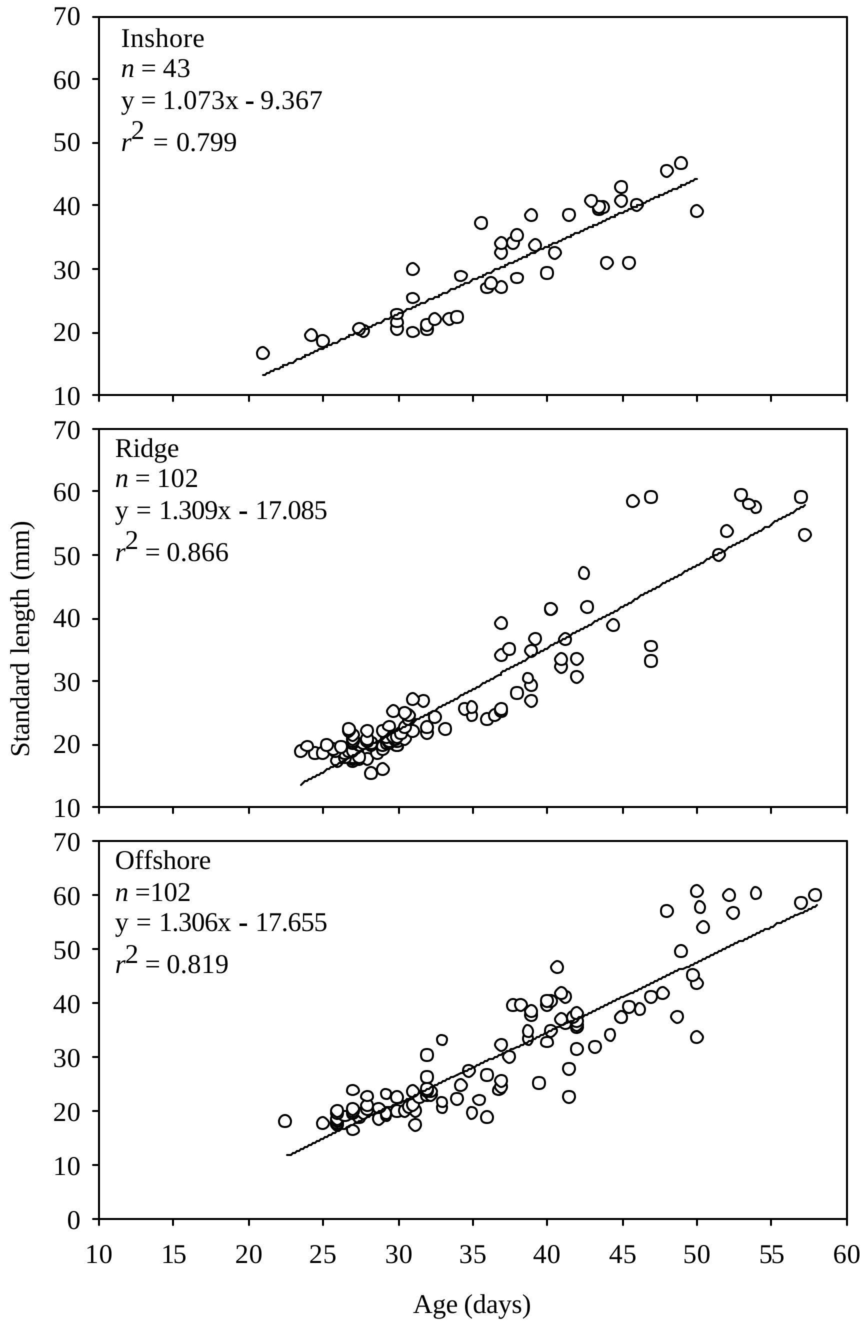

Figure 20. Size-at-age relationships by habitat for post-settlement lane snapper (= 60 mm SL) from Sabine Bank (2003). Linear regression plots and equations included. Growth rate based on slope of regression equation.

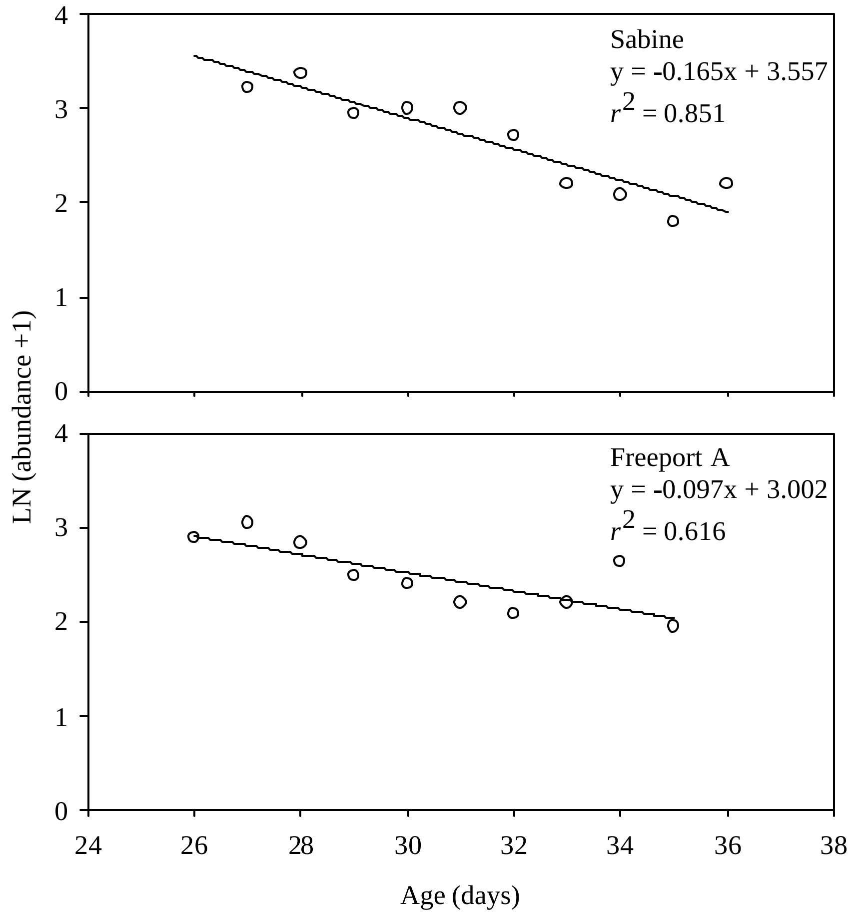

Figure 21. Linear regression of Ln (abundance +1) on age of post-settlement lane snapper from Sabine Bank (2003) and Freeport Rocks A (2000). Age range is from 27-36 d for Sabine and from 26-35 d for Freeport A. Linear regression plots and equations included.

age intervals (27-36 d and 26-35 d, respectively). Differences in mortality among the early season (Z = 0.162) and late season (Z = 0.155) cohorts on Sabine Bank were negligible, (ANCOVA, slopes test, P = 0.894, power = 0.018), thus cohorts were pooled for estimates of habitat-specific mortality at Sabine Bank (Fig. 22). Instantaneous mortality on the ridge habitat at Sabine Bank (Z = 0.275) was significantly higher than estimates from the offshore habitat (Z = 0.111, ANCOVA, slopes test, P = 0.021) (Fig. 23).

G : Z Index

Recruitment potential ($G : Z$) was assessed by bank, on Sabine Bank and Freeport A, and for cohorts, and habitats of Sabine Bank (Table 2, Fig. 24). Both banks had $G : Z$ values close to 1, but slightly higher values were found on Freeport A (0.992) than on Sabine Bank (0.858). On Sabine Bank, the ridge habitat had the lowest recruitment potential (0.491) relative to the offshore (1.329) habitat. The early season (May 1 – June 21) cohort of Sabine Bank had a lower $G : Z$ (0.889) than the late season (June 23 – July 31) cohort (0.902).

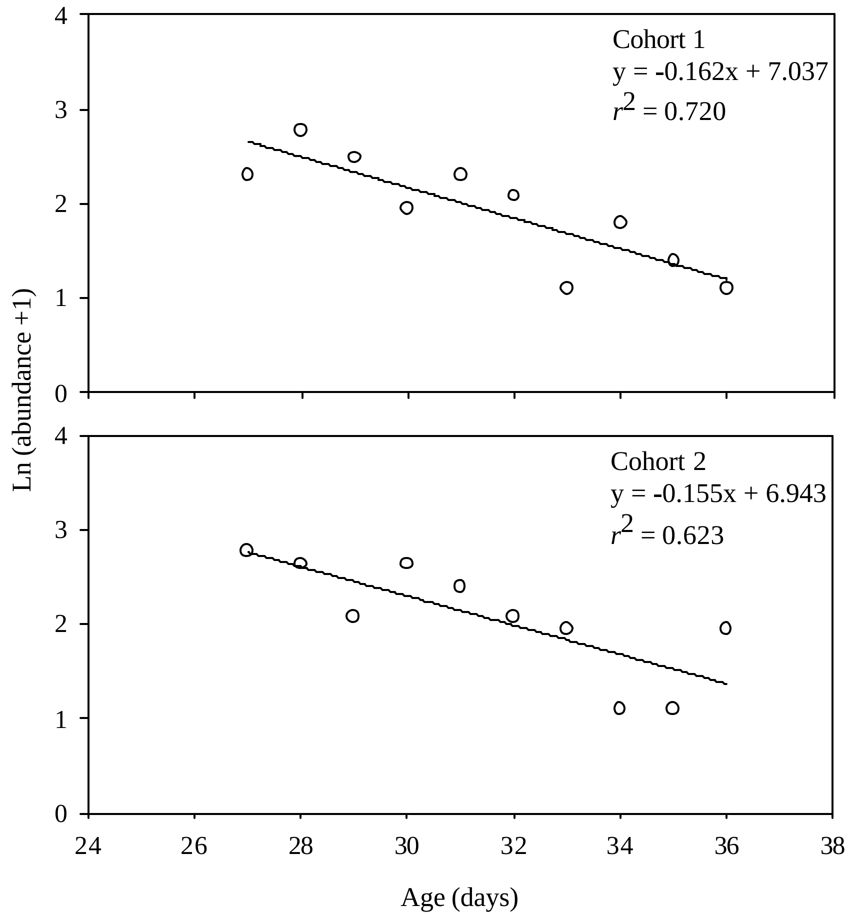

Figure 22. Linear regression of Ln (abundance +1) on age of post-settlement lane snapper for two cohorts from Sabine Bank (2003). Cohort 1 is from May 1 - June 21 and cohort 2 is from June 23 - July 31. Age range is from 27-36 d for both cohorts. Linear regression plots and equations included.

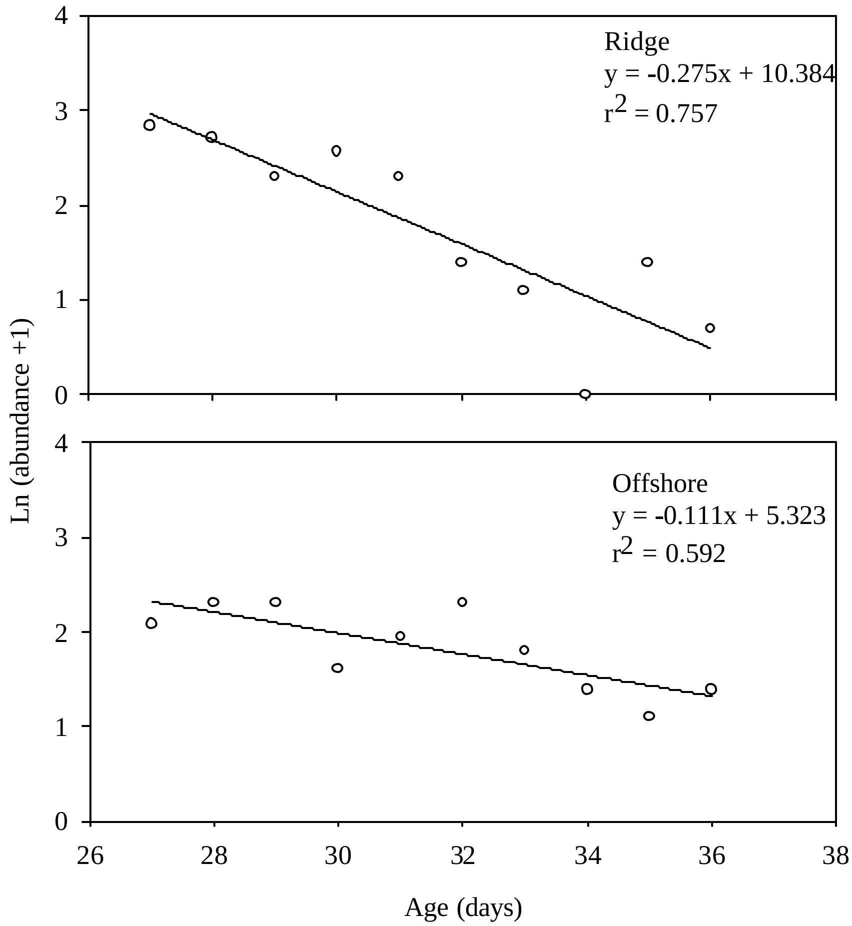

Figure 23. Linear regression of Ln (abundance +1) on age of post-settlement lane snapper from two habitats on Sabine Bank (2003). Age range is from 27-36 d for all habitats. Linear regression plots and equations included.

Table 2. Weight-specific growth (G), mortality (Z), and growth to mortality ratio (G : Z) of post-settlement lane snapper collected from Sabine Bank in 2003. Weight-specific growth, mortality, and the growth to mortality ratio were not determined for the inshore habitat of Sabine Bank due to low sample size (*n* = 59).

Bank and year		G	Z	G : Z
Freeport A	All sites	0.096	0.097	0.992
Sabine 2003	All sites	0.142	0.165	0.858
	Cohort 1	0.144	0.162	0.889
	Cohort 2	0.140	0.155	0.902
	Inshore	NA	NA	NA
	Ridge	0.135	0.275	0.491
	Offshore	0.148	0.111	1.329

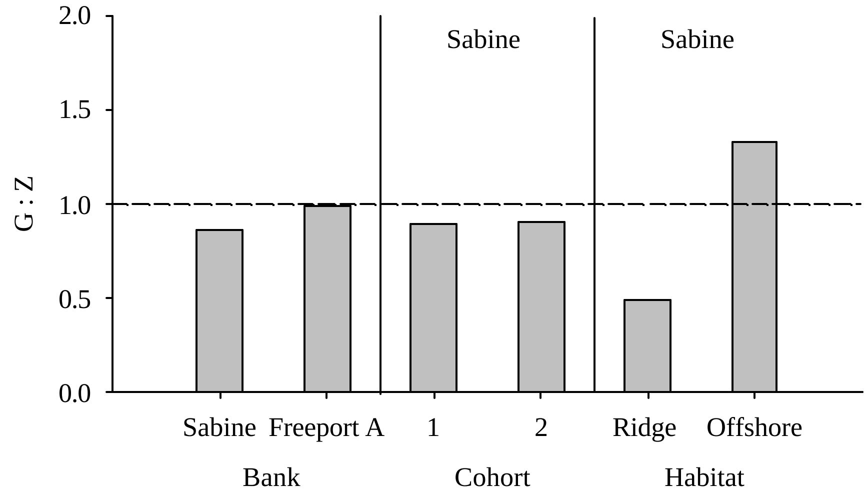

Figure 24. Weight-specific growth (*G*) to instantaneous mortality (*Z*) index by cohort and habitat. Cohort 1 is from May 1 - June 21 and cohort 2 is from June 23-July 31. A *G* : *Z* ratio greater than 1.0 represents a gain in biomass, while a *G* : *Z* ratio less than 1.0 represents a loss in biomass.

DISCUSSION

Three low-relief banks on the mid-continental shelf of the northwestern Gulf of Mexico, Heald Bank, Sabine Bank, and Freeport Rocks, were trawled in this study. These relic barrier islands (Rodriguez et al., 1999; Rodriguez et al., 2000) are composed of a sand and relic shell material, with mud inshore and offshore of the ridge or bathymetric high on each bank. Within banks, habitat designations were based primarily on side-scan mosaics. Percent carbonate composition of sediment was highest on the ridge of both Heald Bank and Sabine Bank, and shell weight collected during trawl surveys was high on ridges and negligible from inshore and offshore mud habitats, providing additional evidence that sampling was conducted within designated habitats.

Low-relief sand and relic shell banks (of similar origin) trawled in the present study also exist off of Alabama (Schroeder et al., 1995), Florida (Mallinson et al., 2003), and the Yucatan Peninsula (Rudenko, 1998); however, banks examined here are somewhat unique in their close proximity to outputs of major fluvial systems, which discharge directly into the Gulf of Mexico (e.g. the Mississippi River to Heald Bank and Sabine Bank, and the Brazos River to Freeport Rocks). Most banks in the Gulf of Mexico receive inputs from riverine systems, draining first through estuaries and thereby lowering the amount of organic matter and nutrients being exported to offshore areas (Boyes and Elliott, 2006). As a result of the proximity of the banks of this study to direct fluvial inputs, secondary production is expected to be high, and the increased availability of prey resources likely enhances the values of these banks as nursery areas of lane snapper and other taxa.

Temperature, salinity, and dissolved oxygen varied across banks, but values of all three parameters were within the presumed range of conditions required by lane snapper. Optimal rearing temperatures reported for juvenile lane snapper in the laboratory are from 25.0 - 28.5 ^{o}C (Clarke et al., 1992; Clarke et al., 1997), and wild lane snapper have been collected from similar water temperatures (27.2 - 29.9 ^{o}C, J. Rooker, unpubl. data). Reported salinity levels from laboratory trials and field collections of larval and early juvenile lane snapper are 31.0 - 38.0, (Drass et al., 2000) and 25.0 - 31.1 (Thayer et al., 1999; Franks and Vanderkooy, 2000), respectively. Mean temperature and salinity on all three banks examined here were 28.5 - 29.2 ^{o}C and 30.3 - 34.9, respectively, and these values are similar to aforementioned ranges reported in the literature for both lab-based and field-based studies. Dissolved oxygen ranged from 4.5 - 5.5 mg L^{-1} across banks, which is close to the lower threshold level of red snapper (Gallaway and Cole, 1999). Although dissolved oxygen has been known to drop below 2 mg L^{-1}at the mouth of the Mississippi River, extending a hypoxic zone as far west as the TX/LA boarder (Rabalais, 2002), this condition was not observed, and thus, dissolved oxygen levels on all three banks were well above the hypoxia threshold during the recruitment period of lane snapper to these areas.

Regional differences in lane snapper abundance were pronounced, with the majority of lane snapper collected from Sabine Bank. Sabine Bank had densities greater than 20 ind ha^{-1}, which was at least twofold higher than any other bank surveyed. Although information on post-settlement lane snapper catch appears to be limited to abundance data (Franks and Vanderkooy, 2000; Hernandez et al., 2001; Brooks et al., unpubl. data), density of post-settlers was reported in a study conducted in Florida Bay, FL. The mean density reported in the Florida Bay study (6 ind ha^{-1}) was approximately one third lower than the density on Sabine Bank (Thayer et al., 1999), one half lower than the density on Freeport A, and comparable to the density observed for Heald Bank and Freeport B. Since post settlement lane snapper and red snapper often occur together during early life, comparisons of density with their congener may shed some light on habitat partitioning between the two species. Post-settlement density of red snapper varies spatially and temporally (Szedlmayer and Conti, 1999; Rooker et al., 2004), with reported densities as high as 90 ind ha^{-1} in the northwestern Gulf of Mexico (Rooker et al., 2004). In contrast to patterns observed for lane snapper, red snapper density was highest on Freeport Rocks (Geary et al., in review), with low numbers observed on Heald Bank and Sabine Bank. Regional differences in density between the two species may be due to environmental conditions, such as lower salinity on certain banks (e.g. Sabine Bank) with higher lane snapper catches, suggesting the relative value of each bank is species specific.

Sampling was conducted during the anticipated peak spawning period of lane snapper, and temporal variability in post-settlement density was pronounced. Similar to other marine teleosts, spawning seasons of lane snapper (Figuerola et al., 1998; Luckhurst et al., 2000) and other lutjanids (Allman and Grimes, 2002; Denit and Sponagule, 2004) are often restricted to specific seasons, and thus intra-annual variability in settlement density was expected. Post-settlement lane snapper were observed on banks from June through September, with peak densities occurring from July and August. Previous studies of the same banks indicated red snapper recruit to these habitats during the same period. Densities in newly settled red snapper were observed from July through September in the northwestern Gulf of Mexico (Rooker et al., 2004) and the same pattern of settlement has been reported for the northeastern Gulf of Mexico (Szedlmayer and Conti, 1999, Szedlmayer and Lee, 2004). Inter-annual variation in settlement is relatively common among lutjanids (Allman and Grimes, 2002; Denit and Sponagule, 2004; Rooker et al., 2004), and often attributed to variation in abiotic or biotic conditions such as temperature (Lankford and Targett, 2001), prey availability (Cowan and Shaw, 2002), and predation mortality (Webster, 2002; Johnson, 2006).

Densities of post-settlement lane snapper were variable across habitats, and patterns were not consistent across banks surveyed. Significantly higher densities of post-settlement lane snapper were found on Sabine Bank's ridge and offshore habitats, relative to its inshore habitat. Conversely, lane snapper densities at Freeport A were significantly higher on the inshore habitat than the offshore habitat. This inconsistency of lutjanid density by habitat was also observed by Rooker et al. (2004) where post-settlement red snapper were found across all habitats, with peak densities occurring on different habitats in different years. Although red snapper have been shown to settle to structured habitat (Szedlmayer and Conti, 1999), it appears that young red snapper settle on both structured (shell ridge), and unstructured (inshore and offshore mud) habitats, and tend to move to structured habitats with increasing size (Szedlmayer and Lee, 2004; Wells and Cowan, in press). Mean sizes of lane snapper within banks were greater on the ridge habitat in 3 of 4 surveys (Sabine Bank, Freeport A and B), suggesting larger individuals select for, or move to structured habitat. However, lane snapper do not appear to favor shell ridge habitats over mud bottoms during the early post-settlement period, and this finding has been reported for red snapper, with comparable numbers of new settlers on mud, sand, and shell habitats (Rooker et al., 2004; Szedlmayer and Lee, 2004). Ontogenetic shifts to more structured habitats by red snapper have been attributed to increased size (Patterson et al., 2005) and a concominant change in diet (Szedlmayer and Lee, 2004) and possibly occur for lane snapper as well.

Otolith microstructure analysis determined that lane snapper settled to demersal habitat on banks in the northwestern Gulf of Mexico at approximately 21-28 d. The observed planktonic larval duration (PLD) of 3-4 weeks is similar to observed planktonic periods of other lutjanids. Reported PLDs of red snapper from the same banks are quite similar (26 d, Rooker et al., 2004; 22 - 28 d, Geary et al., in review). Similarly, gray snapper from the West Florida shelf have a PLD of 25 days (Allman and Grimes, 2002), and a PLD of 24 - 26 d from eastern Florida and North Carolina (Denit and Sponagule, 2004). Also, the timing of settlement has been reported for three species of eastern Pacific snapper (*Lutjanus argentiventris* Peters, 1869; *Lutjanus guttatus* Steindachner, 1869; and *Lutjanus novemfasciatus* Gill, 1862) and PLDs are similar, ranging from 22 - 24 d (Zapata and Herron, 2002). Since the observed PLD of the smallest lane snapper was highly similar across banks and comparable to values reported for other lutjanids, the predicted PLD appears to represent a viable estimate of when settlement occurs for this species.

Hatch dates closely track spawning events (hatching occurs approximately 19-23 h after egg fertilization in lane snapper, as observed by Borrero et al., (1978)), and thus, hatch-date distributions from the present study were compared to spawning dates reported in the literature from other locations. Hatch dates of lane snapper in this study ranged from early May to late August, and estimated hatch times were highly similar to reported spawning times of lane snapper in Bermuda, which range from May through early September, with peaks in June - August (Luckhurst et al., 2000). In warmer waters of the Caribbean, lane snapper are perennial (Acosta and Appeldoorn, 1992), and prolonged spawners (Manickhand-Dass, 1987; Aiken, 2001). Still, times of peak spawning in many of these regions fall within the range observed for lane snapper in the northwestern Gulf of Mexico. Peak spawning in Puerto Rico and Jamaica occurred in May (Acosta and Appeldoorn, 1992), and July – August (Aiken, 2001), respectively. In contrast, peak spawning in Trinidad occurs earlier (March) than any other studies (Manickhand-Dass, 1987). Although perennial spawning is not expected in the northwestern Gulf of Mexico, protracted spawning is possible.

An association between moon phase and peak hatch dates of lane snapper was apparent on Sabine Bank and Freeport A. On Sabine Bank, peaks in the bimodal hatch-date distribution occurred during the new moon and the first quarter. Hatch dates of lane snapper from Freeport A also peaked during the first quarter. The observed association with the new moon phase at Sabine Bank is supported by several other studies that documented peaks in spawning and/or hatch dates of lutjanids during or proximal to the new moon (Watson et al. 2002; Emata, 2003; Tzeng et al., 2003; Denit and Sponagule, 2004). Moreover, in a related study on Freeport Rocks, Geary et al. (in review) reported that hatch dates of red snapper peaked during the new moon. A peak in spawning or hatch during the new moon phase is likely an anti-predator tactic to reduce the success of visual predators that may feed on eggs (Holt et al., 1985), and spawning adults (Nikolsky, 1963). Clearly, dates proximal to the new moon (i.e., first quarter) are also likely to enhance survivorship, since reduced light levels have been shown to reduce the effectiveness of visual predators (James and Heck, 1994).

Previous assessments of growth for lane snapper have focused on larger (>150 mm FL) individuals (Manooch and Mason, 1984; Manickhand-Dass, 1987; Acosta and Appeldoorn, 1992; Johnson et al., 1995; Luckhurst et al., 2000; Aiken, 2001). Thus, otolith-based estimates of growth determined here for post-settlers serve as the baseline for all future studies. In general, growth rates of post-settlement lane snapper ranged from 0.9 - 1.3 mm d^{-1}, and these values are in the upper range of rates reported for post-settlement red snapper in the Gulf of Mexico: 0.78 - 0.8 mm d^{-1} (Rooker et al., 2004), 0.9 - 1.1 mm d^{-1} (Geary et al., in review), and 0.54 - 0.86 mm d^{-1} (Szedlmayer and Conti, 1999). Growth rates of gray snapper in Florida are also comparable to observed values, ranging from 0.6 - 1.0 mm d^{-1} (Allman and Grimes, 2002; Denit and Sponagule, 2004). Overall, growth rates in this study were comparable to studies on congeners from the Gulf of Mexico.

Temporal variation in growth is not uncommon during early life for lutjanids (Allman and Grimes, 2002) as well as other fishes in the Gulf of Mexico (e.g. DeVries and Grimes, 1997; Rooker et al., 1999; Peterson et al., 2004; Wells and Rooker, 2004).

Cohort-specific variation in growth was observed in the present study, with early season settlers growing at a slower rate (1.0 mm d^{-1}) than individuals arriving later in the season (1.4 mm d^{-1}). Cohort-specific differences in growth have been attributed to a variety of factors, including temperature (Taylor and Able, 2006), salinity (Secor et al., 2000), food availability (Cowan and Shaw, 2002; Katersky et al., 2006) and predation mortality (Rilling and Houde, 1999; Taylor and Able, 2006). Slower growth observed for the early season cohort of lane snapper is possibly linked to temperature, since the early cohort experienced cooler conditions, which often results in lower growth in fishes from subtropical (Rooker and Holt, 1997) and temperate environments (Sammons et al., 2001).

Habitat-specific variation in growth was observed, with lower rates on the inshore habitat than either the ridge or offshore habitats; however, no significant difference was detected. Differences in growth rates among habitats have been attributed to prey availability (Comyns et al., 2003) and type (Cowan and Shaw, 2002) and assessments of post-settlement growth of red snapper on banks examined in the present study have detected differences in growth among habitats (Rooker et al., 2004; Geary et al., in review). The lack of significant habitat-specific differences in growth of lane snapper suggests that environmental conditions were relatively consistent across the three habitats. Temperature, typically the primary physical factor affecting growth (Jones, 2002), was not significantly different among habitats, and salinity and dissolved oxygen levels were higher than the minimum thresholds for red snapper (Gallaway and Cole, 1999).

Mortality of post-settlement lane snapper on Sabine Bank (*Z* = 0.165 15.2 % d^{-1}) was almost double that of Freeport A (*Z* = 0.097, 9.2 % d^{-1}). Although no previous mortality estimates of post-settlement lane snapper exist, rates observed in this study were comparable to mortality rates for other species. Rooker et al. (2004) estimated comparable mortalities of 0.129 (12.1%) for post-settlement red snapper on Freeport Rocks in 2000, for individuals approximately 20 days older than (e.g. 47 – 57 d) than ranges of ages used for lane snapper estimates. In addition, mortality coefficients, both higher and lower than those observed in this study, have been estimated from other lutjanids: 0.19 – 0.29 for larval vermillion snapper (*Rhomboplites aurorubens* Cuvier, 1829) (Comyns et al. 2003), 0.04 – 0.28 for juvenile yellowtail snapper (*Ocyurus chrysurus* Bloch, 1791) (Watson et al 2002) and 0.14-0.43 for juvenile gray snapper (Alman and Grimes, 2001). Early life mortality is often linked to water quality (Sponagule and Grorud-Colvert, 2006), and density-dependent processes, such as predation mortality (Holbrook and Schmitt, 2002), starvation (Leggett and DeBlois, 1994; Sogard, 1997), and disease (Houde, 2002). Although it is difficult to determine the exact cause of observed differences in mortality between the two banks examined, both density and mortality of lane snapper were lower on Freeport A, possibly indicating that density-dependent factors could be involved.

Habitat-specific variation in mortality rates was also observed, and rates were more than twice as high (*Z* = 0.275, 24 % d^{-1}) for lane snapper on the ridge than on the offshore habitat. Rooker et al. (2004) found a similar pattern with higher mortality on the ridge (*Z* = 0.12, 11.9 % d^{-1}) relative to the unstructured, mud habitats found inshore

(*Z* = 0.05, 4.4% d^{-1}) and offshore (*Z* = 0.10, 9.3% d^{-1}). Predation during the early post-settlement period is typically high (Houde, 2002; Almany and Webster, 2006), and predator numbers are often higher on structured habitat (Masuda et al., 2003). Therefore, it is possible that higher mortality on the structured, ridge habitat was a function of higher predator numbers in this habitat. Emigration and size-based gear avoidance (i.e. larger individuals are more capable of avoiding the gear) could also contribute in part to higher mortality rates observed on the ridge habitat.

Estimates of weight-specific growth (*G*) and mortality (*Z*) of lane snapper during early life are often combined (*G* : *Z*) to determine recruitment potential (Rutherford et al., 1997; Rooker et al., 1999; Hoffman and Olney, 2005). Cohort and habitat-specific variation in recruitment potential of lane snapper was estimated on Sabine Bank, and ratios were less than 1.0 for both cohort 1 and cohort 2 (habitats pooled), indicating that both cohorts were losing biomass. The only favorable G : Z ratio (greater than 1) was observed for individuals from offshore habitat, with a value of 1.33. This indicated the offshore habitat contributes substantially more individuals to the adult population, and thus, appears to represent nursery habitat, according to the definition of Beck et al. (2003).

SUMMARY AND CONCLUSIONS

My results suggest lane snapper successfully settle across different banks (Heald Bank, Sabine Bank, and Freeport Rocks), and habitats (inshore mud, shell ridge and offshore mud) in the northwestern Gulf of Mexico. Most post-settlement lane snapper were collected from Sabine Bank and from Freeport Rocks, suggesting these banks may serve as important nursery areas for lane snapper. However, post-settlement numbers may vary as a function of interannual variation in recruitment, and thus, collection number alone may not be a useful indicator of nursery quality.

Banks and habitats used by post-settlement snapper were further evaluated by estimating growth, mortality and recruitment potential, since all three parameters are commonly used to evaluate the quality of a habitat or nursery area. Since all three parameters are age based, otolith microstructure analysis was essential data required for these estimates and associated life history parameters (i.e. hatch dates). Key demographic features determined for post-settlement lane snapper in the present study are listed below:

1. Lane snapper settled to demersal habitat in the northwestern Gulf of Mexico from approximately 21-28d
2. Spawning or hatch dates of post-settlement lane snapper peak from early May to late August
3. Growth rates of post-settlement lane snapper are between 0.9 - 1.3 mm d^{-1} and bank and habitat-specific variation in growth were negligible

4. Natural mortality during the early post-settlement period is significant, ranging from 9.2 to 24.0% d^{-1}
5. Recruitment potential ($G : Z$) was highest in the offshore habitat, indicating this habitat contributes disproportionately more to the adult population

Lane snapper are commercially and recreationally important in the Caribbean and to a lesser extent, in the Gulf of Mexico, but have not been extensively researched, particularly during the early life stage. The present study represents one of the first attempts to comprehensively study lane snapper during the early post-settlement period, and will serve as the foundation for future studies. In addition to providing critical information for future demographic studies, this complements earlier efforts to identify the essential nursery habitat of snapper in the Gulf of Mexico. An improved understanding of the role of natural banks and associated habitats as nurseries of red snapper, lane snapper, and associated species is critically needed because these banks are currently being targeted as “sources of sand” for beach replenishment projects (Trembanis and Pilkey, 1998). Beach nourishment projects have already been implemented from Chorpus Christi, TX to Marco Island, FL (Trembanis and Pilkey, 1998), and the banks examined in the present study (e.g. Sabine Bank, Freeport Rocks) are currently being evaluated as potential sand borrow sites for future projects. Clearly, the role of these low-relief banks as potential nursery habitat of snapper is important and warrants further consideration.

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APPENDIX

Date	Site #	Bank	Habitat	Start Depth (m)	End Depth (m)	Start Lat	Stop Lat	Start Long	Stop Long	Shell Weight (kg)	# Lane Snapper
7/2/2003	1	Sabine	Inshore		9.8	29 22.7430	29 22.587	94 01.230	94 01.139	0	1
7/2/2003	2	Sabine	Inshore		9.4	29 22.916	29 22.778	94 00.378	94 00.471	0	7
7/2/2003	3	Sabine	Inshore		9.4	29 22.954	29 22.799	94 00.029	94 00.094	0	6
7/2/2003	4	Sabine	Inshore		9.1	29 23.223	29 23.055	93 59.548	93 59.580	0	1
7/2/2003	5	Sabine	Inshore		8.5	29 23.480	29 23.314	93 58.996	93 59.073	0	0
7/2/2003	6	Sabine	Inshore		8.8	29 23.828	29 23.680	93 58.332	93 58.441	0	3
7/2/2003	7	Sabine	Ridge		8.2	29 23.026	29 22.860	93 58.366	93 58.461	3.2	0
7/2/2003	8	Sabine	Ridge		8.8	29 22.963	29 22.759	93 58.614	93 58.659	< 1 lb	0
7/2/2003	9	Sabine	Ridge		10.1	29 22.626	29 22.470	93 58.852	93 58.947	< 1 lb	1
7/2/2003	10	Sabine	Ridge		10.1	29 22.171	29 22.001	94 00.337	94 00.391	5.0	6
7/2/2003	11	Sabine	Ridge		9.1	29 22.322	29 22.142	94 00.487	94 00.397	1.1	7
7/2/2003	12	Sabine	Ridge		9.1	29 22.095	29 21.949	94 00.102	94 00.231	0.2	9
7/2/2003	13	Sabine	Offshore		11.0	29 21.674	29 21.508	94 00.099	93 59.990	0	0
7/2/2003	14	Sabine	Offshore		11.3	29 21.740	29 21.550	93 59.481	93 59.495	< 1kg	1
7/2/2003	15	Sabine	Offshore		11.0	29 22.027	29 21.857	93 58.940	93 58.820	< 1kg	4
7/2/2003	16	Sabine	Offshore		11.0	29 22.225	29 22.042	93 58.391	93 58.389	0	7
7/2/2003	17	Sabine	Offshore		10.7	29 22.597	29 22.427	93 57.509	93 57.572	< 1kg	8
7/2/2003	18	Sabine	Offshore		10.7	29 22.772	29 22.620	93 57.072	93 57.202	< 1kg	9
7/3/2003	19	Heald	Inshore		9.8	29 8.083	29 7.867	94 11.047	94 11.054	0	0
7/3/2003	20	Heald	Inshore			29 8.281	29 8.113	94 10.643	94 10.579	0	0
7/3/2003	21	Heald	Inshore		9.4	29 8.398	29 8.238	94 10.307	94 10.355	0	0
7/3/2003	22	Heald	Inshore		9.1	29 8.660	29 8.598	94 9.839	94 9.999	< 1kg	0

Date	Site #	Bank	Habitat	Start Depth (m)	End Depth (m)	Start Lat	Stop Lat	Start Long	Stop Long	Shell Weight (kg)	# Lane Snapper
7/3/2003	23	Heald	Ridge		12.8	29 7.743	29 7.575	94 9.728	94 9.773	6.8	0
7/3/2003	24	Heald	Ridge		12.2	29 7.550	29 7.358	94 10.080	94 10.035	6.8	0
7/3/2003	25	Heald	Ridge		10.1	29 7.543	29 7.427	94 10.395	94 10.424	0.5	0
7/3/2003	26	Heald	Ridge		9.1	29 7.451	29 7.337	94 10.034	94 10.544	9.1	0
7/3/2003	27	Heald	Offshore			29 6.744	29 6.607	94 11.030	94 11.021	0.9	0
7/3/2003	28	Heald	Offshore		13.1	29 6.936	29 6.771	94 10.367	94 10.271	10.4	0
7/3/2003	29	Heald	Offshore		13.4	29 7.427	29 7.256	94 9.116	94 9.007	< 1kg	0
7/3/2003	30	Heald	Offshore		14.33	29 7.427	29 7.256	94 9.116	94 9.007	< 1kg	0
7/17/2003	1	Sabine	Inshore		9.9	29 22.910	29 22.794	94 00.964	94 00.803	0.0	4
7/17/2003	2	Sabine	Inshore		9.4	29 23.044	29 22.887	94 00.301	94 00.219	0.0	1
7/17/2003	3	Sabine	Inshore		9.3	29 23.049	29 22.877	93 59.958	93 59.909	< 1kg	5
7/17/2003	4	Sabine	Inshore		9.0	29 23.191	29 22.941	93 59.500	93 59.506	0.0	0
7/17/2003	5	Sabine	Inshore		8.5	29 23.466	29 23.257	93 59.015	93 58.977	< 1 lb	0
7/17/2003	6	Sabine	Inshore		8.7	29 23.775	29 23.573	93 58.189	93 58.221	0.0	0
7/17/2003	7	Sabine	Ridge		9.3	29 23.116	29 22.925	93 58.245	93 58.211	3.9	0
7/17/2003	8	Sabine	Ridge		7.8	29 22.965	29 22.774	93 58.591	93 58.613	4.1	4
7/17/2003	9	Sabine	Ridge		9.1	29 22.561	29 22.361	93 58.741	93 58.714	0.9	1
7/18/2003	10	Sabine	Ridge		9.6	29 22.187	29 22.011	94 00.283	94 00.324	3.6	1
7/18/2003	11	Sabine	Ridge		8.6	29 22.330	29 22.158	94 00.504	94 00.545	0.5	0
7/18/2003	12	Sabine	Ridge		9.8	29 22.086	29 21.917	93 59.958	93 59.900	0.0	0
7/17/2003	13	Sabine	Offshore		9.5	29 21.849	29 21.706	94 00.049	93 59.960	1.6	3
7/17/2003	14	Sabine	Offshore		10.9	29 21.825	29 21.673	93 59.475	93 59.368	0.0	1
7/17/2003	15	Sabine	Offshore		10.6	29 22.149	29 21.975	93 58.909	93 58.837	< 1kg	1
7/17/2003	16	Sabine	Offshore		10.7	29 22.265	29 22.095	93 58.396	93 57.068	< 1kg	15

Date	Site #	Bank	Habitat	Start Depth (m)	End Depth (m)	Start Lat	Stop Lat	Start Long	Stop Long	Shell Weight (kg)	# Lane Snapper
7/17/2003	17	Sabine	Offshore		10.4	29 22.610	29 22.429	93 57.552	93 57.563	< 1kg	1
7/17/2003	18	Sabine	Offshore		10.6	29 22.760	29 22.559	93 57.068	93 57.122	0.0	0
7/18/2003	19	Heald	Inshore		9.3	29 8.010	29 7.967	94 11.207	94 11.406	< 1kg	0
7/18/2003	20	Heald	Inshore			29 8.364	29 8.407	94 10.699	94 10.873	< 1kg	0
7/18/2003	21	Heald	Inshore		8.9	29 8.444	29 8.520	94 10.429	94 10.606	0.0	0
7/18/2003	22	Heald	Inshore		8.9	29 8.599	29 8.657	94 9.996	94 10.0176	< 1kg	0
7/18/2003	23	Heald	Ridge		12.4	29 7.747	29 7.601	94 9.765	94 9.895	5.9	0
7/18/2003	24	Heald	Ridge		13.2	29 7.639	29 7.610	94 10.197	94 10.359	19.1	0
7/18/2003	25	Heald	Ridge		10.9	29 7.516	29 7.529	94 10.387	94 10.601	10.0	0
7/18/2003	26	Heald	Ridge		9.7	29 7.485	29 7.434	94 10.691	94 10.837	1.4	0
7/18/2003	27	Heald	Offshore		12.1	29 6.787	29 6.861	94 11.111	94 11.297	2.0	0
7/18/2003	28	Heald	Offshore		13.5	29 6.961	29 6.856	94 10.294	94 10.441	4.5	0
7/18/2003	29	Heald	Offshore		13.6	29 7.171	29 7.014	94 9.735	94 9.769	0.9	0
7/18/2003	30	Heald	Offshore		13.96	29 7.461	29 7.361	94 9.118	94 9.247	0.9	1
8/4/2003	1	Sabine	Inshore	9.4	9.5	29 22.890	29 22.731	94 01.053	94 01.110	< 1kg	1
8/4/2003	2	Sabine	Inshore	9.2	9.2	29 23.057	29 22.896	94 00.377	94 00.423	2.5	0
8/4/2003	3	Sabine	Inshore	8.8	9.1	29 23.032	29 22.933	93 59.994	94 00.123	6.8	4
8/4/2003	4	Sabine	Inshore	8.8	8.8	29 23.226	29 23.046	93 59.526	93 59.524	14.5	0
8/4/2003	5	Sabine	Inshore	8.6	8.4	29 23.453	29 23.336	93 58.982	93 59.100	1.8	1
8/4/2003	6	Sabine	Inshore	8.6	9.0	29 23.794	29 23.637	93 58.340	93 58.390	8.6	1
8/4/2003	7	Sabine	Ridge	8.8	9.1	29 23.046	29 22.902	93 58.305	93 58.399	11.3	7
8/4/2003	8	Sabine	Ridge	7.9	9.1	29 23.085	29 22.927	93 58.642	93 58.691	8.2	3
8/4/2003	9	Sabine	Ridge	9.9	9.6	29 22.645	29 22.502	93 58.768	93 58.844	5.4	18
8/4/2003	10	Sabine	Ridge	9.7	9.2	29 22.329	29 22.213	94 00.307	94 00.389	10.0	7

Date	Site #	Bank	Habitat	Start Depth (m)	End Depth (m)	Start Lat	Stop Lat	Start Long	Stop Long	Shell Weight (kg)	# Lane Snapper
8/4/2003	11	Sabine	Ridge	9.6	7.8	29 22.482	29 22.350	94 00.550	94 00.618	5.2	28
8/4/2003	12	Sabine	Ridge	9.9	9.0	29 22.151	29 21.991	94 00.060	94 00.108	9.1	4
8/4/2003	13	Sabine	Offshore	10.1	10.5	29 21.617	29 21.605	94 00.222	94 00.224	3.9	7
8/4/2003	14	Sabine	Offshore	10.0	10.5	29 21.889	29 21.740	93 59.467	93 59.495	< 1kg	8
8/4/2003	15	Sabine	Offshore	10.1	10.3	29 22.086	29 21.952	93 59.023	93 59.095	< 1kg	4
8/4/2003	16	Sabine	Offshore	10.1	10.6	29 22.319	29 22.158	93 58.404	93 58.315	0.5	8
8/4/2003	17	Sabine	Offshore	10.1	10.0	29 22.695	29 22.555	93 57.489	93 57.548	0.7	5
8/4/2003	18	Sabine	Offshore	9.8	10.3	29 22.860	29 22.742	93 57.061	93 57.201	0.7	7
8/5/2003	19	Heald	Inshore	9.6	9.9	29 08.999	29 07.870	94 11.112	94 11.196	0	0
8/5/2003	20	Heald	Inshore	8.9	9.4	29 08.303	29 08.156	94 10.552	94 10.559	0	0
8/5/2003	21	Heald	Inshore	9.0	8.8	29 8.496	29 8.386	94 10.412	94 10.441	0	0
8/5/2003	22	Heald	Inshore	8.8	8.9	29 08.648	29 08.493	94 09.908	94 09.891	0	0
8/5/2003	23	Heald	Ridge	12.0	12.5	29 7.860	29 7.774	94 9.674	94 9.717	0.5	1
8/5/2003	24	Heald	Ridge	12.7	10.4	29 7.592	29 7.474	94 10.232	94 10.307	< 1kg	1
8/5/2003	25	Heald	Ridge	10.9	9.3	29 07.525	29 07.397	94 10.419	94 10.471	< 1kg	0
8/5/2003	26	Heald	Ridge	9.9	8.9	29 07.492	29 07.344	94 10.698	94 10.779	< 1kg	0
8/5/2003	27	Heald	Offshore	11.6	12.1	29 06.780	29 06.669	94 11.064	94 11.194	0	3
8/5/2003	28	Heald	Offshore	12.6	13.4	29 07.002	29 06.842	94 10.383	94 10.494	0.5	2
8/5/2003	29	Heald	Offshore	12.2	13.7	29 07.260	29 07.173	94 09.783	94 09.886	0	0
8/5/2003	30	Heald	Offshore	13.6	14.1	29 07.492	29 07.384	94 09.073	94 09.151	< 1kg	0
8/19/2003	1	Sabine	Inshore	9.5	9.3	29 22.848	29 22.701	94 01.007	94.01.073	< 1kg	0
8/19/2003	2	Sabine	Inshore	9.2	9.1	29 23.050	29 22.875	94 00.302	94 00.315	< 1kg	2
8/19/2003	3	Sabine	Inshore	8.8	9.1	29 22.991	29.22.823	93 59.930	93 59.954	2	7
8/19/2003	4	Sabine	Inshore	9.0	8.9	29 23.143	29 22.940	93 59.578	93 59.633	6	0

Date	Site #	Bank	Habitat	Start Depth (m)	End Depth (m)	Start Lat	Stop Lat	Start Long	Stop Long	Shell Weight (kg)	# Lane Snapper
8/19/2003	5	Sabine	Inshore	8.5	8.6	29 23.464	29 23.298	93 59.030	93 59.143	11	0
8/19/2003	6	Sabine	Inshore	8.7	8.9	29 23.619	29 23.462	93 58.404	93 58.538	2	13
8/19/2003	7	Sabine	Ridge	8.2	8.9	29 23.097	29 22.926	93 58.301	93 58.405	9	2
8/19/2003	8	Sabine	Ridge	9.3	9.3	29 22.932	29 22.752	93 58.720	93 58.787	3.5	4
8/19/2003	9	Sabine	Ridge	9.6	9.4	29 22.692	29 22.721	93 58.862	93 59.045	4.5	1
8/19/2003	10	Sabine	Ridge	10.1	8.3	29 22.198	29 22.049	94 00.240	94 00.366	< 1kg	1
8/19/2003	11	Sabine	Ridge	8.6	8.4	29 22.384	29 22.214	94 00.490	94 00.529	4	3
8/19/2003	12	Sabine	Ridge	9.1	9.2	29 22.111	29 21.963	94 00.997	94 00.084	3.5	6
8/19/2003	13	Sabine	Offshore	10.0	10.2	29 21.731	29 21.603	94 00.212	94 00.340	< 1kg	4
8/19/2003	14	Sabine	Offshore	10.2	10.5	29 21.828	29 21.679	93 59.616	93 59.733	< 1kg	7
8/19/2003	15	Sabine	Offshore	10.1	10.2	29 22.127	29 22.021	93 59.002	93 59.169	1	11
8/19/2003	16	Sabine	Offshore	10.2	10.2	29 22.128	29 22.007	93 58.809	93 58.970	< 1kg	0
8/19/2003	17	Sabine	Offshore	9.8	9.9	29 22.648	29 22.584	93 57.681	93 57.873	2	8
8/19/2003	18	Sabine	Offshore	9.8	9.8	29 22.932	29 22.825	93 57.016	93 57.181	2	4
8/20/2003	19	Heald	Inshore	9.8	9.6	29 08.003	29 07.818	94 11.197	94 11.263	1	2
8/20/2003	20	Heald	Inshore	9.1	9.3	29 08.295	29 08.132	94 10.653	94 10.708	0	0
8/20/2003	21	Heald	Inshore	9.1	9.3	29 08.415	29 08.251	94 10.284	94 10.297	0	0
8/20/2003	22	Heald	Inshore	9.1	8.6	29 08.633	29 08.508	94 09.939	94 09.996	0	0
8/20/2003	23	Heald	Ridge	12.7	11.6	29 07.679	29 07.536	94 09.708	94 09.718	12	0
8/20/2003	24	Heald	Ridge	12.5	10.9	29 07.610	29 07.517	94 10.142	94 10.287	4	0
8/20/2003	25	Heald	Ridge	10.4	9.5	29 07.490	29 07.349	94 10.446	94 10.548	3.5	0
8/20/2003	26	Heald	Ridge	9.7	9.1	29 07.541	29 07.284	94 10.742	94 10.753	15	0
8/20/2003	27	Heald	Offshore	12.1	12.1	29 06.795	29 06.632	94 11.132	94 11.196	0	0
8/20/2003	28	Heald	Offshore	13.3	14.4	29 06.963	29 06.787	94 10.307	94 10.326	0	0

Date	Site #	Bank	Habitat	Start Depth (m)	End Depth (m)	Start Lat	Stop Lat	Start Long	Stop Long	Shell Weight (kg)	# Lane Snapper
8/20/2003	29	Heald	Offshore	12.5	13.5	29 07.241	29 07.097	94 09.726	94 09.830		0
8/20/2003	30	Heald	Offshore	12.5	13.5	29 07.241	29 07.097	94 09.195	94 09.329	< 1kg	0
9/9/2003	1	Sabine	Inshore	10.1	10.1	29 22.920	29 23.091	94 01.983	94 00.931	0.2	0
9/9/2003	2	Sabine	Inshore	9.7	9.7	29 23.072	29 23.197	94 00.308	94 00.156	2.3	2
9/9/2003	3	Sabine	Inshore	9.3	9.2	29 23.046	29 23.115	93 59.910	93 59.767	1.8	0
9/9/2003	4	Sabine	Inshore	9.3	9.2	29 23.325	29 23.310	93 59.474	93 59.338	12.7	0
9/9/2003	5	Sabine	Inshore	9.0	9.1	29 23.561	29 23.544	93 58.952	93 58.787	0.0	0
9/9/2003	6	Sabine	Inshore	9.1	8.9	29 23.932	29 23.946	93 58.189	93 58.056	3.6	0
9/9/2003	7	Sabine	Ridge	9.7	10.1	29 23.136	29 23.149	93 58.254	93 58.127	5.0	0
9/9/2003	8	Sabine	Ridge	8.4	9.1	29 23.104	29 23.117	93 58.561	93 58.395	6.8	11
9/9/2003	9	Sabine	Ridge	10.8	10.6	29 22.676	29 22.718	93 58.703	93 58.580	2.3	3
9/9/2003	10	Sabine	Ridge	10.2	10.6	29 22.309	29 22.379	94 00.264	94 00.140	6.8	7
9/9/2003	11	Sabine	Ridge	9.9	10.5	29 22.396	29 22.449	94 00.448	94 00.297	5.9	2
9/9/2003	12	Sabine	Ridge	10.9	11.2	29 22.210	29 22.317	93 59.008	93 59.909	5.4	16
9/9/2003	13	Sabine	Offshore	10.1	10.5	29 21.823	29 21.912	94 00.091	94 00.976	4.3	3
9/9/2003	14	Sabine	Offshore	10.9	10.6	29 21.941	29 22.045	93 59.440	93 59.343	2.0	5
9/9/2003	15	Sabine	Offshore	10.9	10.8	29 22.144	29 22.257	93 58.885	93 58.800	0.5	2
9/9/2003	16	Sabine	Offshore	10.6	10.3	29 22.363	29 22.505	93 58.410	93 58.362	< 1kg	3
9/9/2003	17	Sabine	Offshore	10.6	10.6	29 22.712	29 22.739	93 57.464	93 57.312	0.5	4
9/9/2003	18	Sabine	Offshore	10.6	10.5	29 22.887	29 22.970	93 57.015	93 56.892	0.5	4
9/10/2003	19	Heald	Inshore	9.7	10.3	29 08.063	29 07.899	94 11.212	94 11.236	< 1kg	0
9/10/2003	20	Heald	Inshore	9.2	9.4	29 08.315	29 08.133	94 10.653	94 10.730	0.0	0
9/10/2003	21	Heald	Inshore	9.3	9.1	29 08.494	29 08.381	94 10.347	94 10.453	0.0	0
9/10/2003	22	Heald	Inshore	8.8	8.9	29 08.574	29 08.462	94 09.915	94 10.051	0.0	0

Date	Site #	Bank	Habitat	Start Depth (m)	End Depth (m)	Start Lat	Stop Lat	Start Long	Stop Long	Shell Weight (kg)	# Lane Snapper
9/10/2003	23	Heald	Ridge	12.4	12.5	29 07.798	29 07.661	94 09.709	94 09.880	7.7	0
9/10/2003	24	Heald	Ridge	12.7	10.9	29 07.582	29 07.497	94 10.186	94 10.358	16.6	0
9/10/2003	25	Heald	Ridge	11.5	10.1	29 07.494	29 07.342	94 10.396	94 10.472	22.0	1
9/10/2003	26	Heald	Ridge	10.2	9.4	29 07.482	29 07.309	94 10.728	94 10.810	10.9	0
9/10/2003	27	Heald	Offshore	11.9	13.3	29 06.843	29 06.638	94 11.018	94 11.023	5.4	0
9/10/2003	28	Heald	Offshore	12.9	13.4	29 06.970	29 06.803	94 10.389	94 10.479	2.9	0
9/10/2003	29	Heald	Offshore	12.9	13.7	29 07.180	29 07.966	94 09.738	94 09.726	2.3	1
9/10/2003	30	Heald	Offshore	13.6	14.0	29 07.540	29 07.435	94 09.145	94 09.335	< 1kg	0
7/8/2004	1	Freeport	Inshore	16.9	16.8	28 44.268	28 44.104	95 21.721	95 21.651		0
7/9/2004	2	Freeport	Inshore	16.5	0.0	28 39.629	28 39.448	95 25.505	95 25.541		2
7/9/2004	3	Freeport	Inshore	16.8	0.0	28 40.941	28 40.820	95 25.045	95 24.933		0
7/9/2004	4	Freeport	Inshore	16.8	0.0	28 41.932	28 41.837	95 23.787	95 23.645		0
7/9/2004	5	Freeport	Inshore	16.5	0.0	28 42.823	28 42.680	95 22.694	95 22.649		0
7/8/2004	6	Freeport	Inshore	16.5	16.5	28 43.700	28 43.686	95 21.352	95 21.147	< 1kg	0
7/8/2004	7	Freeport	On Ridge	15.8	16.2	28 42.351	28 42.229	95 21.129	95 21.129	< 1kg	0
7/9/2004	8	Freeport	On Ridge	16.2	0.0	28 41.656	28 41.513	95 22.805	95 21.725	3.2	0
7/9/2004	9	Freeport	On Ridge	14.9	0.0	28 40.515	28 40.377	95 22.754	95 22.741	5.4	3
7/9/2004	10	Freeport	On Ridge	15.2	0.0	28 40.096	28 39.896	95 23.542	95 23.589		0
7/9/2004	11	Freeport	On Ridge	15.2	0.0	28 39.158	28 38.961	95 23.965	95 23.981	2.3	1
7/8/2004	12	Freeport	On Ridge	15.4	15.7	28 44.057	28 44.074	95 18.887	95 18.596	18.1	3
7/8/2004	13	Freeport	Off Ridge	17.7	17.8	28 43.283	28 43.125	95 18.614	95 18.591	< 1kg	0
7/9/2004	14	Freeport	Off Ridge	16.5	0.0	28 38.082	28 38.193	95 24.665	95 24.623		0
7/9/2004	15	Freeport	Off Ridge	15.2	0.0	28 40.320	28 40.112	95 23.893	95 23.894		0
7/8/2004	16	Freeport	Off Ridge	17.5	17.5	28 40.264	28 40.122	95 21.838	95 21.882	4.5	0

Date	Site #	Bank	Habitat	Start Depth (m)	End Depth (m)	Start Lat	Stop Lat	Start Long	Stop Long	Shell Weight (kg)	# Lane Snapper
7/8/2004	17	Freeport	Off Ridge	16.5	16.9	28 41.541	28 41.552	95 21.495	95 21.276		0
7/8/2004	18	Freeport	Off Ridge	15.5	15.4	28 42.745	28 42.900	95 20.325	95 20.175	< 1kg	0
7/8/2004	19	Freeport	Offshore	19.7	19.7	28 41.543	28 41.392	95 18.503	95 18.480		0
7/8/2004	20	Freeport	Offshore	20.6	21.0	28 40.297	28 40.152	95 19.011	95 18.929	0	0
7/8/2004	21	Freeport	Offshore	20.9	20.9	28 39.304	28 39.145	95 20.701	95 20.708	0	0
7/9/2004	22	Freeport	Offshore	21.6	0.0	28 38.254	28 38.355	95 21.863	95 21.726		0
7/9/2004	23	Freeport	Offshore	21.5	21.9	28 37.20	28 37.00	95 23.48	95 23.38	< 1kg	0
7/8/2004	24	Freeport	Offshore	19.4	19.7	28 42.631	28 42.517	95 16.927	95 16.752	< 1kg	0
7/27/2004	1	Freeport	Inshore	17.1	17.2	28 44.451	28 44.495	95 21.749	95 21.670	0	0
7/27/2004	2	Freeport	Inshore	16.6	16.6	28 39.585	28 39.446	95 25.627	95 25.830	0	0
7/27/2004	3	Freeport	Inshore	13.4	15.2	28 40.708	28 40.482	95 25.326	95 25.590	0	0
7/27/2004	4	Freeport	Inshore	17.1	16.9	28 41.830	28 42.008	95 23.921	95 23.920	0	3
7/27/2004	5	Freeport	Inshore	16.9	16.8	28 42.883	28 42.948	95 22.748	95 22.628	0	0
7/27/2004	6	Freeport	Inshore	16.8	16.9	28 43.636	28 43.765	95 21.306	95 21.215	0	0
7/26/2004	7	Freeport	On Ridge	16.2	16.2	28 42.235	28 42.338	95 21.029	95 20.867	3.2	0
7/26/2004	8	Freeport	On Ridge	15.7	15.8	28 41.668	28 41.759	95 22.042	95 21.963	3.6	0
7/27/2004	9	Freeport	On Ridge	16.2	16.0	28 40.492	28 40.577	95 22.686	95 22.490	8.6	0
7/27/2004	10	Freeport	On Ridge	15.4	15.4	28 40.259	28 40.392	95 23.502	95 23.398	0	0
7/27/2004	11	Freeport	On Ridge	15.7	15.5	28 39.191	28 39.271	95 23.939	95 23.796	0	0
7/26/2004	12	Freeport	On Ridge	15.2	15.1	28 43.031	28 44.152	95 18.945	95 18.843	23.4	2
7/26/2004	13	Freeport	Off Ridge	17.8	17.7	28 43.251	28 43.355	95 18.614	95 18.444	< 1kg	0
7/26/2004	14	Freeport	Off Ridge	16.0	16.2	28 38.430	28 38.570	95 25.010	95 24.859		0
7/27/2004	15	Freeport	Off Ridge	15.7	16.0	28 40.464	28 40.489	95 23.834	95 23.678	0	0
7/27/2004	16	Freeport	Off Ridge	17.4	17.7	28 40.311	28 40.515	95 21.764	95 21.714	2.5	0

Date	Site #	Bank	Habitat	Start Depth (m)	End Depth (m)	Start Lat	Stop Lat	Start Long	Stop Long	Shell Weight (kg)	# Lane Snapper
7/27/2004	17	Freeport	Off Ridge	16.6	16.5	28 41.621	28 41.809	95 21.525	95 21.615	1.4	0
7/26/2004	18	Freeport	Off Ridge	16.5	16.0	28 42.586	28 42.720	95 20.269	95 20.165	5.9	0
7/26/2004	19	Freeport	Offshore	20.1	19.8	28 41.671	28 41.828	95 18.410	95 18.326	< 1kg	0
7/26/2004	20	Freeport	Offshore	20.4	20.6	28 40.358	28 40.533	95 19.074	95 18.973	< 1kg	0
7/26/2004	21	Freeport	Offshore	21.2	20.4	28 39.389	28 39.570	95 20.726	95 20.701	0	0
7/26/2004	22	Freeport	Offshore	21.8	21.0	28 38.132	28 38.190	95 21.971	95 21.813	0	0
7/26/2004	23	Freeport	Offshore	21.8	21.6	28 37.208	28 37.325	95 23.428	95 23.290	0	0
7/26/2004	24	Freeport	Offshore	19.5	19.2	28 42.618	28 42.749	95 16.896	95 16.777	< 1kg	0
8/10/2004	1	Freeport	Inshore	16.8	16.8	28 44.217	28 44.020	95 21.925	95 22.048	< 1kg	0
8/10/2004	2	Freeport	Inshore	16.3	16.2	28 39.691	28 39.485	95 25.623	95 25.742	0	0
8/10/2004	3	Freeport	Inshore	16.3	16.5	28 40.852	28 40.919	95 25.190	95 25.412	0	0
8/10/2004	4	Freeport	Inshore	16.6	16.5	28 41.991	28 42.055	95 24.098	95 24.328	0	0
8/10/2004	5	Freeport	Inshore	16.5	16.3	28 42.870	28 42.808	95 22.760	95 22.617	0	0
8/10/2004	6	Freeport	Inshore	16.3	16.3	28 43.466	28 43.273	95 21.560	95 21.694	0	0
8/10/2004	7	Freeport	On Ridge	15.7	15.8	28 42.223	28 42.223	95 21.213	95 21.040		2
8/10/2004	8	Freeport	On Ridge	15.4	16.0	28 41.619	28 41.445	95 22.083	95 22.039	2.5	3
8/10/2004	9	Freeport	On Ridge	15.4	14.9	28 40.441	28 40.253	95 22.662	95 22.676	15	0
8/10/2004	10	Freeport	On Ridge	14.9	14.9	28 40.123	28 39.900	95 23.594	95 23.670	0	4
8/10/2004	11	Freeport	On Ridge	15.4	15.5	28 39.122	28 39.004	95 24.061	95 24.276	< 1kg	0
8/10/2004	12	Freeport	On Ridge	15.1	15.4	28 44.011	28 44.042	95 18.873	95 18.742	2	2
8/10/2004	13	Freeport	Off Ridge	17.4	17.7	28 43.231	28 43.232	95 18.689	95 18.559	1.8	0
8/10/2004	14	Freeport	Off Ridge	16	16.3	28 38.427	28 38.230	95 25.202	95 25.368	3.4	6
8/10/2004	15	Freeport	Off Ridge	15.2	15.4	28 40.285	28 40.129	95 23.919	95 24.083		0
8/10/2004	16	Freeport	Off Ridge	16.8	17.1	28 40.282	28 40.099	95 22.000	95 22.077	5.2	0

Date	Site #	Bank	Habitat	Start Depth (m)	End Depth (m)	Start Lat	Stop Lat	Start Long	Stop Long	Shell Weight (kg)	# Lane Snapper
8/10/2004	17	Freeport	Off Ridge	16.3	16.6	28 41.449	28 41.262	95 21.580	95 21.556	0	0
8/10/2004	18	Freeport	Off Ridge	15.8	16.3	28 42.551	28 42.482	95 20.471	95 20.364	2.7	0
8/11/2004	19	Freeport	Offshore	20.0	20.1	28 41.561	28 41.433	95 18.579	95 18.731		0
8/11/2004	20	Freeport	Offshore	20.7	20.6	28 40.214	28 40.067	95 19.158	95 19.312	< 1kg	0
8/11/2004	21	Freeport	Offshore	20.7	20.7	28 39.267	28 39.117	95 20.849	95 20.977	< 1kg	1
8/11/2004	22	Freeport	Offshore	21.2	21.5	28 38.133	28 37.994	95 21.918	95 22.021	0	2
8/11/2004	23	Freeport	Offshore	21.2	21.5	28 37.138	28 36.916	95 23.507	95 23.617		0
8/11/2004	24	Freeport	Offshore	19.7	20.0	28 42.522	28 42.285	95 16.909	95 16.922		0
9/2/2004	1	Freeport	Inshore	16.6	16.6	28 44.255	28 44.087	95 21.867	95 2.959		16
9/1/2004	2	Freeport	Inshore	16.6	16.6	28 39.726	28 39.846	95 25.434	95 25.353	< 1kg	1
9/1/2004	3	Freeport	Inshore	16.8	16.8	28 40.854	28 40.915	95 25.011	95 24.888		0
9/1/2004	4	Freeport	Inshore	16.9	16.5	28 41.878	28 41.958	95 23.856	95 23.761		0
9/2/2004	5	Freeport	Inshore	16.5	16.5	28 42.897	28 42.869	95 22.621	95 22.443		0
9/2/2004	6	Freeport	Inshore	16.5	16.6	28 43.695	28 43.804	95 21.448	95 21.625		0
9/2/2004	7	Freeport	On ridge	16.2	16.2	28 42.248	28 42.347	95 21.012	95 20.872		2
9/2/2004	8	Freeport	On ridge	16.2	16.6	28 41.488	28 41.326	95 21.973	95 21.893		0
9/2/2004	9	Freeport	On ridge	15.7	15.2	28 40.368	28 40.290	95 22.936	95 23.137	13.2	0
9/1/2004	10	Freeport	On ridge	15.1	15.2	28 40.154	28 40.310	95 23.454	95 23.418		0
9/1/2004	11	Freeport	Off ridge	15.5	15.4	28 39.162	28 39.287	95 24.131	95 24.064		0
9/2/2004	12	Freeport	On ridge	15.1	15.5	28 43.998	28 43.810	95 18.894	95 18.812	19.5	0
9/2/2004	13	Freeport	Off ridge	17.8	18.1	28 43.159	28 42.956	95 18.616	95 18.547		0
9/1/2004	14	Freeport	Off ridge	16.6	16.6	28 38.415	28 38.498	95 24.985	95 24.896	2.7	0
9/1/2004	15	Freeport	Off ridge	15.5	15.5	28 40.455	28 40.588	95 23.758	95 23.713		0
9/2/2004	16	Freeport	Off ridge	17.4	17.8	28 40.253	28 40.072	95 21.905	95 22.000	3.6	0

Date	Site #	Bank	Habitat	Start Depth (m)	End Depth (m)	Start Lat	Stop Lat	Start Long	Stop Long	Shell Weight (kg)	# Lane Snapper
9/2/2004	17	Freeport	Off ridge	16.6	16.6	28 41.398	28 41.263	95 21.633	95 21.784		1
9/2/2004	18	Freeport	Off ridge	16.2	16.5	28 42.495	28 42.356	95 20.461	95 20.629		0
9/1/2004	19	Freeport	Offshore	19.5	19.5	28 41.612	28 41.556	95 18.773	95 19.011	< 1kg	1
9/1/2004	20	Freeport	Offshore	20.6	20.4	28 40.231	28 40.185	95 19.331	95 19.571		0
9/1/2004	21	Freeport	Offshore	20.4	21.2	28 39.277	28 39.167	95 20.950	95 21.186		0
9/1/2004	22	Freeport	Offshore	21.3	21.2	28 38.133	28 38.213	95 25.931	95 21.826		3
9/1/2004	23	Freeport	Offshore	21.3	21.5	28 37.282	28 37.374	95 23.330	95 23.201		0
9/1/2004	24	Freeport	Offshore	19.2	19.4	28 42.600	28 42.70	95 17.06	95 17.018	< 1kg	0
9/28/2004	1	Freeport	Inshore	56.5	56.5	28 44.323	28 44.367	95 21.664	95 21.473	< 1kg	0
9/29/2004	2	Freeport	Inshore	53.5	53.5	28 39.821	28 39.822	95 25.4	95 25.180		1
9/29/2004	3	Freeport	Inshore	55	55	28 40.860	28 40.851	95 25.992	95 24.776		0
9/29/2004	4	Freeport	Inshore	54.5	55	28 41.968	28 41.986	95 23.818	95 23.582		0
9/29/2004	5	Freeport	Inshore	54.5	54.5	28 42.853	28 42.814	95 22.583	95 22.359		0
9/28/2004	6	Freeport	Inshore	55.5	55.5	28 43.670	28 43.816	95 21.246	95 21.076		0
9/28/2004	7	Freeport	On ridge	54.5	53.5	28 42.293	28 42.434	95 21.018	95 20.888		0
9/29/2004	8	Freeport	On ridge	52	53.5	28 41.643	28 41.577	95 21.956	95 21.770	< 1kg	1
9/29/2004	9	Freeport	On ridge	52	51.5	28 40.449	28 40.421	95 22.669	95 22.467	9.1	0
9/29/2004	10	Freeport	On ridge	50	51.5	28 40.185	28 40.229	95 23.384	95 23.177	< 1kg	0
9/29/2004	11	Freeport	Off ridge	57	55	28 39.195	28 39.153	95 23.923	95 28.709	< 1kg	0
9/28/2004	12	Freeport	On ridge	52	53.5	28 44.007	28 44.018	95 18.828	95 18.609	15.9	4
9/28/2004	13	Freeport	Off ridge	60	58.9	28 43.271	28 43.403	95 18.583	95 18.461		0
9/29/2004	14	Freeport	Off ridge	55	56	28 38.430	28 38.412	95 25.002	95 24.805		0
9/29/2004	15	Freeport	Off ridge	51.5	50.5	28 40.391	28 40.350	95 29.739	95 23.545		0
9/29/2004	16	Freeport	Off ridge	57.5	59	28 40.326	28 40.385	95 21.776	95 21.548	4.1	1

Date	Site #	Bank	Habitat	Start Depth (m)	End Depth (m)	Start Lat	Stop Lat	Start Long	Stop Long	Shell Weight (kg)	# Lane Snapper
9/29/2004	17	Freeport	Off ridge	54.5	55	28 41.514	28 41.505	95 21.421	95 21.209		0
9/28/2004	18	Freeport	Off ridge	54.5	55	28 42.538	28 42.641	95 20.293	95 20.136	9.1	0
9/28/2004	19	Freeport	Offshore	66.5	66.0	28 41.563	41.554	95 18.447	95 18.261		1
9/28/2004	20	Freeport	Offshore	69	69	28 40.287	28 40.453	95 19.078	95 19.041		0
9/28/2004	21	Freeport	Offshore	69	69	28 39.402	28 39.516	95 20.875	95 20.746		1
9/28/2004	22	Freeport	Offshore	71	71	28 38.160	28 38.259	95 21.964	95 21.841		0
9/28/2004	23	Freeport	Offshore	70.5	70.5	28 37.065	28 37.009	95 23.779	95 23.995		0
9/28/2004	24	Freeport	Offshore	64.5	65	28 42.517	28 42.438	95 16.955	95 17.143		1

Date	Site #	Bank	Habitat	Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
7/5/2000	1	Freeport	Ridge						
7/5/2000	2	Freeport	Ridge			36.3		27.5	
7/5/2000	3	Freeport	Offshore			34.1		27.7	
7/5/2000	4	Freeport	Offshore			34.1		27.9	
7/5/2000	5	Freeport	Ridge						
7/5/2000	6	Freeport	Offshore						
7/5/2000	7	Freeport	Offshore						
7/5/2000	8	Freeport	Ridge			34.1		28.2	
7/5/2000	9	Freeport	Ridge			34.3		27.4	
7/5/2000	10	Freeport	Ridge						
7/5/2000	11	Freeport	Offshore			34.3		27.3	
7/5/2000	12	Freeport	Offshore			34.8		26.1	
7/5/2000	13	Freeport	Inshore						
7/5/2000	14	Freeport	Inshore						
7/5/2000	15	Freeport	Inshore						
7/5/2000	16	Freeport	Inshore			34.2		28.1	
7/5/2000	17	Freeport	Inshore						
7/5/2000	18	Freeport	Inshore						

Date	Site #	Bank	Habitat	Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
7/17/2000	1	Freeport	Ridge						
7/17/2000	2	Freeport	Ridge			37.4		27.5	
7/17/2000	3	Freeport	Offshore			34.7		27.5	
7/17/2000	4	Freeport	Offshore			34.6		27.4	
7/17/2000	5	Freeport	Ridge						
7/17/2000	6	Freeport	Offshore			35.1		27.1	
7/17/2000	7	Freeport	Offshore						
7/17/2000	8	Freeport	Ridge						
7/17/2000	9	Freeport	Ridge						
7/17/2000	10	Freeport	Ridge			34.9		26.8	
7/17/2000	11	Freeport	Offshore			35		26	
7/17/2000	12	Freeport	Offshore						
7/17/2000	13	Freeport	Inshore						
7/17/2000	14	Freeport	Inshore			35.3		26.8	
7/17/2000	15	Freeport	Inshore			35		27.6	
7/17/2000	16	Freeport	Inshore			34.8		27.7	
7/17/2000	17	Freeport	Inshore						
7/17/2000	18	Freeport	Inshore						

Date	Site #	Bank	Habitat	Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
8/17/2000	1	Freeport	Ridge			34.7	5.3	29.12	
8/17/2000	2	Freeport	Ridge						
8/17/2000	3	Freeport	Offshore			34.7	5.54	29.11	
8/17/2000	4	Freeport	Offshore			34.7	6.37	28.82	
8/17/2000	5	Freeport	Ridge			34.7	5.45	29.13	
8/17/2000	6	Freeport	Offshore			34.7	5.85	29.15	
8/17/2000	7	Freeport	Offshore			34.7	5.36	28.89	
8/17/2000	8	Freeport	Ridge			34.9	5.31	29.13	
8/17/2000	9	Freeport	Ridge						
8/17/2000	10b	Freeport	Ridge			34.9	5.91	29	
8/17/2000	11	Freeport	Offshore			34.9	5.9	28.28	
8/17/2000	12	Freeport	Offshore			35	5.6	26.87	
8/17/2000	13	Freeport	Inshore			34.9	5.28	29.11	
8/17/2000	14	Freeport	Inshore			34.9	5.13	29.22	
8/17/2000	15	Freeport	Inshore			34.8	5.23	29.11	
8/17/2000	16	Freeport	Inshore			34.8	5.07	29.1	
8/17/2000	17	Freeport	Inshore						
8/17/2000	18	Freeport	Inshore						

Date	Site #	Bank	Habitat	Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
8/31/2000	1	Freeport	Ridge						
8/31/2000	2	Freeport	Ridge			35	5.53	29.85	
8/31/2000	3	Freeport	Offshore						
8/31/2000	4	Freeport	Offshore			34.9	5.81	29.4	
8/31/2000	5	Freeport	Ridge			35	5.83	29.65	
8/31/2000	6	Freeport	Offshore			34.9	5.74	29.7	
8/31/2000	7	Freeport	Offshore			34.9	5.71	29.42	
8/31/2000	8	Freeport	Ridge			34.9	5.56	29.69	
8/31/2000	9	Freeport	Ridge			34.8	5.74	29.66	
8/31/2000	10b	Freeport	Ridge						
8/31/2000	11	Freeport	Offshore			34.9	5.79	29.55	
8/31/2000	12	Freeport	Offshore						
8/31/2000	13	Freeport	Inshore						
8/31/2000	14	Freeport	Inshore			34.8	5.63	29.94	
8/31/2000	15	Freeport	Inshore						
8/31/2000	16	Freeport	Inshore						
8/31/2000	17	Freeport	Inshore						
8/31/2000	18	Freeport	Inshore			35	5.37	29.89	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
7/2/2003	3	Sabine	Inshore	**Surface**	0.6	43.1	27.8	5.13	29.3	1
				Middle	5.5	43.1	27.8	5.01	29.29	
				Bottom	11.3	43.2	27.8	5.06	29.23	
7/2/2003	6	Sabine	Inshore	**Surface**	0.5	43.1	27.8	5.35	29.82	1
				Middle	5.2	43.2	27.8	5.27	29.26	
				Bottom	9.4	43.2	27.9	5.96	29.24	
7/2/2003	9	Sabine	Ridge	**Surface**	0.6	43.1	27.8	5.53	29.98	1
				Middle	5.4	43.1	27.8	5.47	29.43	
				Bottom	11.4	43.2	27.8	6.05	29.34	
7/2/2003	12	Sabine	Ridge	**Surface**	0.7	43	27.7	5	29.24	1
				Middle	5.3	43	27.7	4.88	29.23	
				Bottom	10.5	43.1	27.8	4.98	29.31	
7/2/2003	15	Sabine	Offshore	**Surface**	0.8	42.9	27.6	5.21	29.43	1
				Middle	5.9	42.9	27.7	5.32	29.24	
				Bottom	11.7	43.1	27.8	5.2	29.41	
7/2/2003	18	Sabine	Offshore	**Surface**	0.8	42.2	27.2	5.58	29.68	1
				Middle	5.9	42.9	27.6	5.53	29.5	
				Bottom	11.4	43.2	27.8	4.91	29.39	
7/17/2003	1	Sabine	Inshore	**Surface**	0.9	40.5	25.9	6.06	30.96	
				Middle	5.1	41.1	26.3	4.7	28.77	
				Bottom	10.2	42	27	4.15	28.69	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
7/17/2003	2	Sabine	Inshore	**Surface**	1	40.4	25.9	5.92	30.48	
				Middle	5.1	41	26.2	6.28	29.52	
				Bottom	10	41.7	26.8	4.65	28.75	
7/17/2003	3	Sabine	Inshore	**Surface**	0.9	40.5	25.9	5.97	30.04	
				Middle	4.6	40.6	25.9	5.69	28.92	
				Bottom	9.9	41.7	26.8	4.57	28.75	
7/17/2003	4	Sabine	Inshore	**Surface**	0.9	40.5	25.9	5.63	30.34	
				Middle	4.9	40.7	26.1	4.82	28.7	
				Bottom	9.7	42.1	27	4.07	28.64	
7/17/2003	5	Sabine	Inshore	**Surface**	0.8	40.8	25.9	5.74	31.11	
				Middle	4.9	40.8	26.1	4.99	28.71	
				Bottom	9.4	41.9	26.9	4.57	28.59	
7/17/2003	6	Sabine	Inshore	**Surface**	0.9	39.8	25.4	5.79	30.33	
				Middle	4.8	40.6	26	5.42	28.84	
				Bottom	9.5	41.4	26.6	3.69	28.61	
7/17/2003	7	Sabine	Ridge	**Surface**	1	39.9	25.4	6.81	30.49	
				Middle	4.8	40.8	26.1	5.75	28.95	
				Bottom	10.1	41.1	26.3	4.45	28.71	
7/17/2003	8	Sabine	Ridge	**Surface**	0.8	40.3	25.7	6.33	30.29	
				Middle	4.3	40.7	26.1	5.22	28.78	
				Bottom	8.5	41.2	26.4	4.5	28.68	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
7/17/2003	9	Sabine	Ridge	**Surface**	0.8	40	25.5	6.94	31.19	
				Middle	5	40.8	26.1	4.85	28.77	
				Bottom	10.9	42.1	27	3.74	28.59	
7/18/2003	10	Sabine	Ridge	**Surface**	0.7	40.8	26.2	5.47	29.07	
				Middle	4.9	40.9	26.2	5.24	29.05	
				Bottom	10.8	41.8	26.8	4.38	28.84	
7/18/2003	11	Sabine	Ridge	**Surface**	0.8	40.8	26.1	5.09	28.87	
				Middle	4.7	40.8	26.1	5.04	29.9	
				Bottom	9.2	42	26.9	4.18	28.76	
7/18/2003	12	Sabine	Ridge	**Surface**	1.1	41	26.3	5.37	29	light chop
				Middle	5.7	41.1	26.4	5.32	28.96	
				Bottom	10.8	41.5	26.7	4.66	28.94	
7/17/2003	13	Sabine	Offshore	**Surface**	1	40.9	26.2	7.13	31.15	
				Middle	5.1	41.2	26.4	5.68	29.27	
				Bottom	10.6	41.6	26.7	4.79	28.86	
7/17/2003	14	Sabine	Offshore	**Surface**	0.9	40.5	25.9	6.04	30.48	
				Middle	5	41.1	26.3	5.69	29.27	
				Bottom	10	41.3	26.5	5.92	28.94	
7/17/2003	15	Sabine	Offshore	**Surface**	1.2	40.3	25.8	6.16	31.01	
				Middle	5.2	40.8	26.2	5.3	28.94	
				Bottom	10.9	42	26.9	4.56	28.7	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
7/17/2003	16	Sabine	Offshore	**Surface**	0.9	40.3	25.7	6.8	30.64	
				Middle	5.3	40.9	26.2	4.86	28.76	
				Bottom	11	41.9	26.9	4.08	28.65	
7/17/2003	17	Sabine	Offshore	**Surface**	0.9	39.3	25.2	6.84	31.93	
				Middle	5.5	40.8	26.1	5.52	28.92	
				Bottom	10.2	41.1	26.3	4.27	28.7	
7/17/2003	nd attem	Sabine	Offshore	**Surface**	1.1	39.8	25.4	6.97	30.76	
				Middle	5.3	40.8	26.2	5.99	29.05	
				Bottom	10.5	41.1	26.4	5.13	28.74	
7/18/2003	19	Heald	Inshore	**Surface**	0.9	42.5	27.4	5.53	29.18	
				Middle	5.1	43.3	27.9	5.59	28.86	
				Bottom	10.2	44.6	28.9	4.64	28.57	
7/18/2003	20	Heald	Inshore	**Surface**	1.1	42.2	27.1	5.35	29.01	
				Middle	5.3	43.3	28	5.5	28.84	
				Bottom	9.3	44.6	28.9	4.59	28.57	
7/18/2003	21	Heald	Inshore	**Surface**	0.7	42.2	27.2	5.16	28.72	
				Middle	5.2	43.5	28.1	5.02	28.67	
				Bottom	10	44.5	28.8	4.7	28.52	
7/18/2003	22	Heald	Inshore	**Surface**	0.9	42.3	27.2	5.21	28.64	
				Middle	4.9	43.4	28.1	5.11	28.63	
				Bottom	9.7	44.5	28.8	4.86	28.51	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
7/18/2003	23	Heald	Ridge	**Surface**	0.8	24.5	27.3	5.09	28.67	
				Middle	6.4	44.7	28.6	4.72	28.53	
				Bottom	12.9	45	29.2	4.3	28.5	
7/18/2003	24	Heald	Ridge	**Surface**	0.9	42.6	27.4	5.22	28.71	
				Middle	6.3	44.2	28.8	5	28.6	
				Bottom	13.6	44.9	29.1	4.5	28.51	
7/18/2003	25	Heald	Ridge	**Surface**	1.3	42.5	27.4	5.34	28.84	
				Middle	6.3	44.1	28.6	5.17	28.63	
				Bottom	12.5	44.9	29.1	4.65	28.55	
7/18/2003	26	Heald	Ridge	**Surface**	0.8	42.6	27.4	5.38	28.8	
				Middle	5.2	43.8	28.3	5.27	28.74	
				Bottom	10.7	44.9	29.1	4.5	28.54	
7/18/2003	27	Heald	Offshore	**Surface**	0.9	43.9	28.3	5.44	28.96	
				Middle	6.5	44.1	28.4	5.36	28.77	
				Bottom	12.7	45	29.2	4.37	28.52	
7/18/2003	28	Heald	Offshore	**Surface**	0.8	42.9	27.7	5.44	28.76	
				Middle	6.7	44.7	28.9	5.1	28.65	
				Bottom	13.3	45.2	29.3	4.53	28.45	
7/18/2003	29	Heald	Offshore	**Surface**	0.7	42.5	27.3	5.28	28.72	
				Middle	6.8	44.4	28.7	4.87	28.51	
				Bottom	13.3	45.3	29.3	4.78	28.42	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
7/18/2003	30	Heald	Offshore	**Surface**	1	42.2	27.1	5.13	28.63	
				Middle	7	44.7	28.9	4.82	28.58	
				Bottom	14	45.3	29.4	4.62	28.42	
8/4/2003	1	Sabine	Inshore	**Surface**	0.9	48.3	31.6	5.61	29.84	
				Middle	4.9	48.3	31.6	5.29	29.71	
				Bottom	10.1	48.6	31.8	6	29.49	
8/4/2003	2	Sabine	Inshore	**Surface**	0.6	48.3	31.5	5.17	29.88	
				Middle	4.5	48.2	31.5	5.3	29.75	
				Bottom	9.5	48.4	31.7	5.7	29.43	
8/4/2003	3	Sabine	Inshore	**Surface**	0.7	48.2	31.5	5.17	29.82	
				Middle	4.5	48.3	31.6	5.29	29.63	
				Bottom	9.3	48.4	31.6	5.94	29.44	
8/4/2003	4	Sabine	Inshore	**Surface**	0.9	48.3	31.6	5.13	29.45	waves 2-3 ft./ sunny
				Middle	3.9	48.3	31.6	5.16	29.34	
				Bottom	9.5	48.5	31.7	5.68	29.27	
8/4/2003	5	Sabine	Inshore	**Surface**	0.8	48.4	31.7	5.14	29.36	waves 2-3 ft./ sunny
				Middle	4.2	48.4	31.6	5.28	29.29	
				Bottom	8.7	48.4	31.7	6.1	29.24	
8/4/2003	6	Sabine	Inshore	**Surface**	0.9	48.6	31.8	5.03	29.3	waves 2-3 ft./ sunny
				Middle	4	48.6	31.8	5.04	29.24	
				Bottom	9.5	48.7	31.8	5.14	29.2	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
8/4/2003	7	Sabine	Ridge	**Surface**	1	48.4	31.6	5.05	29.49	waves 2-3 ft./ sunny
				Middle	4.5	48.4	31.7	5.25	29.33	
				Bottom	8.7	48.5	31.7	5.95	29.31	
8/4/2003	8	Sabine	Ridge	**Surface**	1	48.4	31.7	5.14	29.54	waves 2-3 ft./ sunny
				Middle	4.5	48.4	31.7	5.39	29.36	
				Bottom	8.5	48.4	31.7	6.6	29.33	
8/4/2003	9	Sabine	Ridge	**Surface**	1	48.3	31.6	5.02	29.58	
				Middle	5.1	48.3	31.6	5.12	29.42	
				Bottom	10	48.4	31.6	5.37	29.39	
8/4/2003	10	Sabine	Ridge	**Surface**	1	48.2	31.5	5.02	29.89	
				Middle	5.3	48.3	31.6	5.31	29.44	
				Bottom	9.8	48.3	31.6	5.45	29.51	
8/4/2003	11	Sabine	Ridge	**Surface**	1	48.2	31.5	4.98	29.87	
				Middle	5.1	48.4	31.6	5.34	29.43	
				Bottom	10.2	48.4	31.7	6.51	29.49	
8/4/2003	12	Sabine	Ridge	**Surface**	1.2	48.3	31.6	5.02	29.83	
				Middle	5.2	48.2	31.5	5.3	29.46	
				Bottom	10.5	48.3	31.5	5.9	29.47	
8/4/2003	13	Sabine	Offshore	**Surface**	1.2	48.3	31.6	5.12	29.84	
				Middle	5.4	48.2	31.5	5.38	29.63	
				Bottom	9.8	48.3	31.6	7.08	29.48	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
8/4/2003	14	Sabine	Offshore	**Surface**	1	48.2	31.5	5.04	29.82	
				Middle	5.3	48.2	31.5	5.22	29.66	
				Bottom	10.7	48.3	31.5	6	29.42	
8/4/2003	15	Sabine	Offshore	**Surface**	1	48.2	31.5	5.06	29.79	
				Middle	5	48.3	31.5	5.62	29.42	
				Bottom	10.4	48.2	31.5	6.44	29.37	
8/4/2003	16	Sabine	Offshore	**Surface**	1	48.1	31.4	5.11	29.77	
				Middle	5	48.2	31.5	5.22	29.52	
				Bottom	10.2	48.2	31.6	5.8	29.43	
8/4/2003	17	Sabine	Offshore	**Surface**	1	48.4	31.7	5.17	29.73	
				Middle	5.4	48.5	31.7	5.25	29.38	
				Bottom	10.1	48.5	31.7	5.5	29.37	
8/4/2003	18	Sabine	Offshore	**Surface**	1	48.5	31.7	5.07	29.7	
				Middle	5.4	48.6	31.8	5.16	29.43	
				Bottom	10	48.6	31.8	5.42	29.38	
8/5/2003	19	Heald	Inshore	**Surface**	1.2	47.7	31.1	4.99	29.77	
				Middle	5.1	47.6	31.1	5.09	29.73	
				Bottom	9.8	47.8	31.1	5.71	29.65	
8/5/2003	20	Heald	Inshore	**Surface**	1.1	47.7	31.1	5.05	29.7	
				Middle	4.9	47.6	31.1	5.09	29.67	
				Bottom	8.9	47.7	31.1	5.53	29.62	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
8/5/2003	21	Heald	Inshore	**Surface**	1.3	47.7	31.1	5.05	29.7	
				Middle	5.4	47.6	31	5.17	29.71	
				Bottom	9.2	47.7	31.2	5.21	29.68	
8/5/2003	22	Heald	Inshore	**Surface**	1	47.6	31	5.15	29.67	
				Middle	4.5	47.5	31	5.24	29.68	
				Bottom	9.5	47.5	31	5.45	29.68	
8/5/2003	23	Heald	Ridge	**Surface**	0.9	47.4	30.9	5.08	29.7	
				Middle	6	47.4	30.9	5.11	29.71	
				Bottom	12.5	48.6	31.8	5.05	29.33	
8/5/2003	24	Heald	Ridge	**Surface**	0.9	47.3	30.8	5.04	29.76	
				Middle	6.1	47.2	30.8	5.1	29.75	
				Bottom	12.1	48.4	31.7	5.29	29.46	
8/5/2003	25	Heald	Ridge	**Surface**	1.1	47.3	30.9	5	29.87	
				Middle	5.2	47.4	30.9	5.11	29.77	
				Bottom	11.9	48.3	31.6	5.25	29.44	
8/5/2003	26	Heald	Ridge	**Surface**	0.8	47.4	30.9	5.01	29.89	
				Middle	5.1	47.5	31	5.07	29.77	
				Bottom	10.2	48.3	31.5	5.41	29.56	
8/5/2003	27	Heald	Offshore	**Surface**	0.8	47.3	30.8	5.03	29.96	
				Middle	5.4	47.5	31	5.06	29.78	
				Bottom	11.4	48.5	31.8	5.53	29.26	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
8/5/2003	28	Heald	Offshore	**Surface**	1.1	47.3	30.8	5.03	30.03	waves 3-4 feet/ overcast
				Middle	5.5	47.4	30.9	5.23	29.77	
				Bottom	12	48.5	31.7	5.68	29.26	
8/5/2003	29	Heald	Offshore	**Surface**	1.2	47.2	30.8	4.99	29.8	
				Middle	5.9	47.1	30.8	5.14	29.79	
				Bottom	11.6	48.5	31.7	5.48	29.12	
8/5/2003	30	Heald	Offshore	**Surface**	1	47.2	30.8	5.05	29.79	
				Middle	6.5	47.1	30.8	5.17	29.8	
				Bottom	13.6	48.7	31.8	5.43	29.06	
8/19/2003	1	Sabine	Inshore	**Surface**	0.7	49.4	32.3	4.89	30.15	
				Middle	5.2	49.5	32.5	4.9	29.64	
				Bottom	10.3	49.8	32.7	4.19	29.65	
8/19/2003	2	Sabine	Inshore	**Surface**	0.7	49.3	32.3	4.83	30.23	
				Middle	4.5	49.4	32.4	4.85	29.69	
				Bottom	9.2	49.8	32.7	4.03	29.68	
8/19/2003	3	Sabine	Inshore	**Surface**	0.6	49.3	32.3	4.81	30.21	
				Middle	4.8	49.5	32.4	4.85	29.66	
				Bottom	9.6	49.7	32.5	4.12	29.69	
8/19/2003	4	Sabine	Inshore	**Surface**	0.9	49	32.2	4.76	29.44	
				Middle	5.2	49.5	32.4	4.63	29.55	
				Bottom	9.6	49.6	32.5	4.11	29.58	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
8/19/2003	5	Sabine	Inshore	**Surface**	0.9	48.9	31.9	4.77	29.34	
				Middle	4.7	49.4	32.4	4.68	29.52	
				Bottom	9.5	49.4	32.4	4.76	29.52	
8/19/2003	6	Sabine	Inshore	**Surface**	0.9	49.4	32.2	4.66	29.47	
				Middle	4.9	49.3	32.4	4.55	29.49	
				Bottom	9.6	49.4	32.3	4.79	29.49	
8/19/2003	7	Sabine	Ridge	**Surface**	0.9	49.2	32.3	4.63	29.65	
				Middle	4.7	49.5	32.4	4.57	29.54	
				Bottom	9.6	49.4	32.4	4.72	29.52	
8/19/2003	8	Sabine	Ridge	**Surface**	0.8	49.1	32.1	4.7	29.8	
				Middle	4.4	49.5	32.4	4.62	29.58	
				Bottom	8.7	49.4	32.4	4.75	29.56	
8/19/2003	9	Sabine	Ridge	**Surface**	0.9	49.1	32.1	4.72	29.75	
				Middle	5.1	49.5	32.4	4.74	29.58	
				Bottom	10.7	49.5	32.3	5.11	29.56	
8/19/2003	10	Sabine	Ridge	**Surface**	1	49.1	32.2	4.83	30.4	
				Middle	5.6	49.4	32.4	4.78	29.67	
				Bottom	10.8	49.6	32.5	4.55	29.67	
8/19/2003	11	Sabine	Ridge	**Surface**	0.7	49.2	32.2	4.81	30.43	
				Middle	5.2	49.4	32.4	4.77	29.65	
				Bottom	10.5	49.6	32.5	4.41	29.67	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
8/19/2003	12	Sabine	Ridge	**Surface**	1	49.1	32.2	4.82	30.44	
				Middle	4.9	49.4	32.4	4.83	29.69	
				Bottom	9.9	49.6	32.5	4.48	29.66	
8/19/2003	13	Sabine	Offshore	**Surface**	0.9	49.1	32.2	4.85	30.36	
				Middle	5.3	49.5	32.4	4.96	29.65	
				Bottom	10.5	49.5	32.4	5.5	29.63	
8/19/2003	14	Sabine	Offshore	**Surface**	0.8	48.9	32	4.8	30.48	
				Middle	5.5	49.4	32.4	4.8	29.66	
				Bottom	10.6	49.5	32.4	4.66	29.63	
8/19/2003	15	Sabine	Offshore	**Surface**	0.8	48.6	31.8	4.93	30.17	
				Middle	5.4	49.3	32.3	4.8	29.62	
				Bottom	11	49.3	32.3	4.95	29.59	
8/19/2003	16	Sabine	Offshore	**Surface**	0.7	49	32.2	4.77	30.25	
				Middle	5.4	49.3	32.3	4.87	29.59	
				Bottom	10.6	49.4	32.3	4.94	29.55	
8/19/2003	17	Sabine	Offshore	**Surface**	0.8	49	32	4.6	29.87	
				Middle	5	49.4	32.3	4.64	29.5	
				Bottom	10	49.4	32.3	4.64	29.5	
8/19/2003	18	Sabine	Offshore	**Surface**	0.8	48.2	31.5	4.81	30	
				Middle	5	49.3	32.3	4.82	29.51	
				Bottom	10.4	49.2	32.3	4.67	29.48	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
8/20/2003	19	Heald	Inshore	**Surface**	0.8	50	32.8	4.97	29.52	
				Middle	5	50	32.8	5.09	29.48	
				Bottom	10.3	50.6	33.2	4.85	29.66	
8/20/2003	20	Heald	Inshore	**Surface**	0.8	50.1	32.8	4.96	29.49	
				Middle	4.9	50	32.8	4.96	29.48	
				Bottom	9.8	50.7	33.3	4.86	29.65	
8/20/2003	21	Heald	Inshore	**Surface**	0.9	50.1	32.9	4.97	29.46	
				Middle	5.2	50.1	32.9	4.93	29.46	
				Bottom	9.9	50.7	33.3	4.87	29.63	
8/20/2003	22	Heald	Inshore	**Surface**	1	50.1	32.9	5.04	29.47	
				Middle	5.5	50.2	32.9	4.91	29.49	
				Bottom	9.8	50.7	33.3	4.95	29.63	
8/20/2003	23	Heald	Ridge	**Surface**	1.2	50	32.8	4.97	29.44	
				Middle	6.6	50.1	32.9	4.96	29.47	
				Bottom	12.8	50.2	33	4.88	29.61	
8/20/2003	24	Heald	Ridge	**Surface**	0.8	50	32.8	4.9	29.39	
				Middle	6.4	50	32.9	4.85	29.44	
				Bottom	13.4	50.2	33	4.73	29.55	
8/20/2003	25	Heald	Ridge	**Surface**	0.9	49.9	32.7	4.87	29.52	
				Middle	5.6	49.9	32.8	4.88	29.44	
				Bottom	11.7	49.9	32.8	5.18	29.44	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
8/20/2003	26	Heald	Ridge	**Surface**	0.8	49.9	32.7	4.8	29.53	
				Middle	5.2	49.9	32.7	4.88	29.45	
				Bottom	10.1	50.2	33	4.57	29.62	
8/20/2003	27	Heald	Offshore	**Surface**	1	49.9	32.7	4.78	29.65	
				Middle	6.2	49.9	32.7	4.81	29.43	
				Bottom	12.1	50.2	32.9	4.97	29.57	
8/20/2003	28	Heald	Offshore	**Surface**	0.9	50	32.8	4.86	29.62	
				Middle	6.4	50	32.8	4.88	29.49	
				Bottom	13	50.1	32.9	4.87	29.65	
8/20/2003	29	Heald	Offshore	**Surface**	0.9	50	32.9	4.91	29.44	
				Middle	6.4	50.1	32.8	4.97	29.44	
				Bottom	13.2	50.3	33	4.83	29.61	
8/20/2003	30	Heald	Offshore	**Surface**	0.8	50.1	32.9	4.97	29.46	
				Middle	7.3	50.1	32.9	4.97	29.47	
				Bottom	14.5	50.4	33.1	4.92	29.62	
7/8/2004	1	Freeport	Inshore	**Surface**	1	50	29.2	5.01	29.4	
				Bottom	55.5	53.4	33.5	3.66	27.3	
7/9/2004	2	Freeport	Inshore	**Surface**	1	50.2	31.8	5	29.3	
				Bottom	54	53.6	33.9	3.5	27	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
7/9/2004	3	Freeport	Inshore	**Surface**	1	52.8	32	4.64	29	
				Bottom	55	53.6	33.9	3.4	27	
7/9/2004	4	Freeport	Inshore	**Surface**	1	52.3	31.6	4.7	29	
				Bottom	55	53.6	33.6	3.7	27.4	
7/9/2004	5	Freeport	Inshore	**Surface**	1	52	31.4	4.9	28.9	
				Bottom	54	53.6	33.5	3.6	27.5	
7/8/2004	7	Freeport	On Ridge	**Surface**	1	52	31.3	5.1	29.2	2
				Bottom	52.5	54.1	33.6	4.66	27.9	
7/9/2004	8	Freeport	On Ridge	**Surface**	1	49.1	31.3	5	29	2.3
				Bottom	53	37.1	33.6	3.9	27.5	
7/9/2004	9	Freeport	On Ridge	**Surface**	1	52	31.5	4.7	28.9	
				Bottom	49	53.9	33.7	4.2	27.6	
7/9/2004	10	Freeport	On Ridge	**Surface**	1	48.7	31.7	4.5	28.9	
				Bottom	50	53.9	33.8	3.6	27.4	
7/9/2004	11	Freeport	On Ridge	**Surface**	1	53.5	32.4	4.6	29	
				Bottom	50	51.4	33.7	3.4	27.3	
7/8/2004	12	Freeport	On Ridge	**Surface**	1	48.1	30	4.99	29.4	2
				Bottom	49.5	50.8	33.2	4.84	27.7	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
7/8/2004	13	Freeport	On Ridge	**Surface**	1	45.9	29.4	5.07	29.3	2
				Bottom	58	53.4	34.2	3.5	26.7	
7/9/2004	14	Freeport	Off Ridge	**Surface**	1	53	31.9	4.4	29.2	
				Bottom	54	53.8	33.9	3.72	27.3	
7/9/2004	15	Freeport	Off Ridge	**Surface**	1	46.8	30.1	4.7	28.9	
				Bottom	50	53.6	33.8	3.7	27.2	
7/8/2004	16	Freeport	Off Ridge	**Surface**	1	46.4	30.2	4.93	29.3	2
				Bottom	57	53.4	34.3	3.36	26.3	
7/8/2004	17	Freeport	Off Ridge	**Surface**	1	52.4	31.5	4.91	29.3	
				Bottom	55	53.6	34.3	3.68	26.5	
7/8/2004	18	Freeport	Off Ridge	**Surface**	1	50.4	30.1	5.11	29.2	2
				Bottom	53	54.1	33.6	4.76	27.9	
7/8/2004	19	Freeport	Offshore	**Surface**	1	49.6	29.6	5.23	29.4	2
				Bottom	64.5	53.2	34.3	3.84	26.3	
7/8/2004	20	Freeport	Offshore	**Surface**	1	45.7	29.4	5.07	29.6	2
				Bottom	68.5	53	34.2	3.76	26.1	
7/8/2004	21	Freeport	Offshore	**Surface**	1	50.7	29.6	5.03	29.4	2
				Bottom	67.5	53	34.3	3.47	25.9	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
7/8/2004	24	Freeport	Offshore	**Surface**	1	49.2	29.1	5.18	29.5	2
				Bottom	63	53.2	34.3	4.05	26.4	
7/27/2004	1	Freeport	Inshore	**Surface**	1	57.2	34.1	5.75	30.2	
				Bottom	56	57.8	35.6	5.95	28.6	
7/27/2004	2	Freeport	Inshore	**Surface**	1	58.5	35.2	5.9	29.9	
				Bottom	54.5	57.3	36	3.93	27.8	
7/27/2004	3	Freeport	Inshore	**Surface**	1	58.7	35.4	5.92	29.8	
				Bottom	55	57.9	35.6	5.5	28.4	
7/27/2004	4	Freeport	Inshore	**Surface**	1	53	34.8	5.72	29.9	
				Bottom	54.5	58.5	35.2	6.11	29.7	
7/27/2004	5	Freeport	Inshore	**Surface**	1	57.4	34.4	5.77	29.9	
				Bottom	55	58.2	35.1	6.06	29.6	
7/27/2004	6	Freeport	Inshore	**Surface**	1	52.7	34.6	5.8	29.9	
				Bottom	55	54.1	35.6	5.17	28.6	
7/26/2004	7	Freeport	On Ridge	**Surface**	1	58.6	35.2	5.52	29.9	
				Bottom	53	54.6	36.1	4.89	27.6	
7/26/2004	8	Freeport	On Ridge	**Surface**	1	58.4	35.1	5.6	29.9	
				Bottom	52.5	57.3	36	4.71	27.9	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
7/27/2004	9	Freeport	On Ridge	**Surface**	1	58.6	35.3	5.78	29.8	
				Bottom	52.5	58.3	35.8	5.77	28	
7/27/2004	10	Freeport	On Ridge	**Surface**	1	54.4	35.2	5.77	29.8	
				Bottom	49	58.7	35.5	6.04	29.1	
7/27/2004	11	Freeport	On Ridge	**Surface**	1	52.9	34.8	5.76	29.8	
				Bottom	51	53.7	35.3	6	29.9	
7/26/2004	12	Freeport	On Ridge	**Surface**	1	54	35.5	5.77	30	
				Bottom	50	57.1	36	4.23	27.6	
7/26/2004	13	Freeport	Off Ridge	**Surface**	1	59	35.5	5.85	29.9	
				Bottom	59.5	54.5	36	4.63	27.8	
7/26/2004	14	Freeport	Off Ridge	**Surface**	1	58.7	34.9	5.66	30.4	
				Bottom	52.5	58.3	36	5.6	28.6	
7/27/2004	15	Freeport	Off Ridge	**Surface**	1	58.4	35.2	5.73	29.8	
				Bottom	52	58.4	35.5	5.55	29.3	
7/27/2004	16	Freeport	Off Ridge	**Surface**	1	53.7	35.3	5.77	29.7	
				Bottom	58.5	58.4	35.6	5.93	29.1	
7/27/2004	17	Freeport	Off Ridge	**Surface**	1	58.4	35.3	5.76	29.7	
				Bottom	56.5	57.8	35.8	4.45	28.2	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
7/26/2004	18	Freeport	Off Ridge	**Surface**	1	53.6	35.2	5.78	30	
				Bottom	54	57.9	45.7	5.33	28.1	
7/26/2004	19	Freeport	Offshore	**Surface**	1	53.2	35	5.55	30	
				Bottom	67.7	54.7	36.2	5.25	27.5	
7/26/2004	20	Freeport	Offshore	**Surface**	1	52.9	34.7	5.67	30	
				Bottom	63.5	54.8	36.3	5.1	27.1	
7/26/2004	21	Freeport	Offshore	**Surface**	1	53	34.8	5.71	30.3	
				Bottom	66.5	54.9	36.3	5.02	27	
7/26/2004	22	Freeport	Offshore	**Surface**	1	58.4	34.8	5.63	30.3	
				Bottom	69.5	56.9	36.3	4.82	26.9	
7/26/2004	23	Freeport	Offshore	**Surface**	1	58.7	35	5.65	30.2	
				Bottom	70.5	56.9	36.3	4.93	26.9	
7/26/2004	24	Freeport	Offshore	**Surface**	1	53	35.4	5.79	30	
				Bottom	63	54.6	36.1	4.58	27.6	
8/10/2004	1	Freeport	Inshore	**Surface**	1	49.6	32.5	5.09	31	
				Bottom	64.8	51.4	33.5	5.24	30.09	
8/10/2004	2	Freeport	Inshore	**Surface**	1	50.5	33.1	5.19	30.87	
				Bottom	63.3	52	34.4	5.54	29.72	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
8/10/2004	3	Freeport	Inshore	**Surface**	1	49.5	32.4	5.32	31.34	
				Bottom	63.9	52	34.3	4.99	29.72	
8/10/2004	4	Freeport	Inshore	**Surface**	1	49.6	32.5	5.16	31.2	
				Bottom	54	51.8	34.1	**5.23?**	29.91	
8/10/2004	5	Freeport	Inshore	**Surface**	1	49.5	32.4	5.26	30.9	
				Bottom	64	51.5	33.9	5.26	30.01	
8/10/2004	6	Freeport	Inshore	**Surface**	1	49.6	32.5	5.07	30.87	
				Bottom	64.2	51.5	34	5.3	30.01	
8/10/2004	7	Freeport	On Ridge	**Surface**	1	50	32.8	5.24	30.91	
				Bottom	60	51.6	34	5.73	30	
8/10/2004	8	Freeport	On Ridge	**Surface**	1	51	33.5	5.18	30.9	
				Bottom	60.1	51.6	34	5.9	30	
8/10/2004	9	Freeport	On Ridge	**Surface**	1	50.9	33.4	5.14	30.76	
				Bottom	60.4	51.8	34.2	5.23	29.89	
8/10/2004	10	Freeport	On Ridge	**Surface**	1	50.8	33.3	5.08	30.82	
				Bottom	58	52.2	34.4	5.16	29.72	
8/10/2004	11	Freeport	On Ridge	**Surface**	1	50.7	33.3	5.21	31.27	
				Bottom	60	52.3	34.5	5.27	29.63	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
8/10/2004	12	Freeport	On Ridge	**Surface**	1	48.6	31.8	5.59	30.71	
				Bottom	58.8	51.5	33.9	5.43	30	
8/10/2004	13	Freeport	Off Ridge	**Surface**	1	48.7	31.9	5.65	30.9	
				Bottom	66.4	51.6	34	5.66	30.01	
8/10/2004	14	Freeport	Off Ridge	**Surface**	1	50.8	33.4	5.18	30.74	
				Bottom	61.7	52.1	34.4	5.31	29.53	
8/10/2004	15	Freeport	Off Ridge	**Surface**	1	50.6	33.2	5.27	30.83	
				Bottom	59.3	519	34.2	6.15	29.74	
8/10/2004	16	Freeport	Off Ridge	**Surface**	1	50.9	33.5	5.22	30.77	
				Bottom	63.8	52.2	34.5	5.77	29.81	
8/10/2004	17	Freeport	Off Ridge	**Surface**	1	51	33.5	5.29	30.93	
				Bottom	63.7	51.7	34.1	5.51	29.99	
8/10/2004	18	Freeport	Off Ridge	**Surface**	1	49.2	32.2	5.31	31.1	
				Bottom	58.5	51.5	34	5.92	30	
8/11/2004	19	Freeport	Offshore	**Surface**	1	49.2	32.2	5.21	30.18	2-3 ft.
				Bottom	76.4	52.2	34.6	5.21	29.62	
8/11/2004	20	Freeport	Offshore	**Surface**	7.4	50.7	33.3	5.17	30.17	
				Bottom	79.1	52.8	34.9	4.92	29.58	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
8/11/2004	21	Freeport	Offshore	**Surface**	7.7	51.2	33.5	5.31	30.15	
				Bottom	79.3	52.9	35	5.34	29.54	
8/11/2004	22	Freeport	Offshore	**Surface**	7.1	50.8	33.4	5.24	30.1	
				Bottom	61.2	52.9	34.9	4.84	29.9	
8/11/2004	23	Freeport	Offshore	**Surface**	7.2	51	33.6	5.2	30.15	
				Bottom	81.2	52.9	34.9	3.81	29.23	
8/11/2004	24	Freeport	Offshore	**Surface**	1	48.9	32	5.2	30.35	1-2 ft.
				Bottom	75.3	51.7	34.1	4.84	19.82	
9/2/2004	1	Freeport	Inshore	**Surface**	55.4	33.3	5.18	29.6	3.6	< 1 ft
				Bottom	55.4	33.4	5.29	29.5	54.5	
9/1/2004	2	Freeport	Inshore	**Surface**	55.1	33.2	5.62	29.5	3.6	2-3ft
				Bottom	56	34.2	4.53	29.8	54.4	
9/1/2004	3	Freeport	Inshore	**Surface**	55.3	33.3	5.65	29.5	3.6	2 ft
				Bottom	56.3	33.9	5.22	29.6	55	
9/1/2004	4	Freeport	Inshore	**Surface**	55.1	33.2	5.59	29.5	3.6	2 ft
				Bottom	56.1	33.7	5.37	29.7	54	
9/2/2004	5	Freeport	Inshore	**Surface**	55.4	33.3	5.36	29.5	3.6	< 1 ft
				Bottom	55.4	33.4	4.86	25.9	54	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
9/2/2004	6	Freeport	Inshore	**Surface**	55.3	33.3	5.23	29.5	3.6	< 1 ft
				Bottom	55.3	33.3	5.12	29.4	54	
9/2/2004	7	Freeport	On ridge	**Surface**	55.1	32.8	5.56	29.4	3.6	< 1 ft
				Bottom	55.4	33.5	5.22	29.5	52.5	
9/2/2004	8	Freeport	On ridge	**Surface**	55	33.1	5.34	29.4	3.6	< 1 ft
				Bottom	55.6	33.5	5.19	29.6	52.5	
9/2/2004	9	Freeport	On ridge	**Surface**	55	33.2	5.23	29.4	3.6	1 ft
				Bottom	56.1	33.7	4.8	29.6	51.5	
9/1/2004	10	Freeport	On ridge	**Surface**	54.9	33.1	5.7	29.5	3.6	2-3ft
				Bottom	56.8	34.1	4.6	29.7	50	
9/1/2004	11	Freeport	Off ridge	**Surface**	53.6	33.1	5.64	29.6	3.6	2-3ft
				Bottom	57	34.2	4.34	29.8	50	
9/2/2004	12	Freeport	On ridge	**Surface**	55.1	33.2	5.19	29.4	3.6	< 1 ft
				Bottom	55.2	33.4	5.3	29.4	50	
9/2/2004	13	Freeport	Off ridge	**Surface**	55.2	33.2	5.28	29.5	3.6	1 ft
				Bottom	55.8	33.5	4.23	29.6	58	
9/1/2004	14	Freeport	Off ridge	**Surface**	52	30.7	5.62	29.6	3.6	2-3ft
				Bottom	57.1	34.3	4.07	29.8	53.5	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
9/1/2004	15	Freeport	Off ridge	**Surface**	54	33.1	5.63	29.4	3.6	2 ft
				Bottom	56.7	34.1	4.97	29.8	51	
9/2/2004	16	Freeport	Off ridge	**Surface**	54.9	33.1	5.36	29.4	3.6	1 ft
				Bottom	56.1	33.7	4.68	29.6	56.5	
9/2/2004	17	Freeport	Off ridge	**Surface**	55.1	33.1	5.43	29.5	3.6	1 ft
				Bottom	55.7	33.5	5	29.6	54.5	
9/2/2004	18	Freeport	Off ridge	**Surface**	55.4	33.3	5.37	29.5	3.6	< 1 ft
				Bottom	55.6	33.5	5.42	29.5	53	
9/1/2004	19	Freeprot	Offshore	**Surface**	53.70	32	5.43	29.6	3.6	2-3ft
				Bottom	57.50	34.8	3.53	29.5	64	Mod. Wind
9/1/2004	20	Freeprot	Offshore	**Surface**	54.90	32.9	5.34	29.6	3.6	2ft
				Bottom	57.60	34.9	3.14	29.5	67.5	Overcast
9/1/2004	21	Freeprot	Offshore	**Surface**	52.20	31.1	5.76	29.6	3.6	2ft
				Bottom	57.50	34.7	2.99	29.5	67	Some wind
9/1/2004	22	Freeprot	Offshore	**Surface**	55.10	33	5.52	29.6	3.6	2-3ft
				Bottom	57.50	34.7	2.97	29.6	70	
9/1/2004	23	Freeprot	Offshore	**Surface**	52.90	33.9	5.55	29.7	3.6	2-3ft
				Bottom	57.50	34.7	2.93	29.6	70	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
9/1/2004	24	Freeprot	Offshore	**Surface**	60.30	40.5	5.12	29.44	3.6	2ft
				Bottom	63.00	42	3.44	29.24	63.8	Overcast
9/28/2004	1	Freeport	Inshore	**Surface**	3.6	47.74	28.6	5.81	28.9	
				Bottom	56.5	54.10	31.4	3.71	29.1	
9/29/2004	2	Freeport	Inshore	**Surface**	3.6	46.97	28.5	5.96	28.2	
				Bottom	54	58.1	35.5	3.38	29	
9/29/2004	3	Freeport	Inshore	**Surface**	3.6	46.85	28.4	5.72	28.2	
				Bottom	55	57.5	35.2	3.43	28.9	
9/29/2004	4	Freeport	Inshore	**Surface**	3.6	46.75	28.3	5.64	28.3	
				Bottom	54.5	56.7	34.6	3.34	28.9	
9/29/2004	5	Freeport	Inshore	**Surface**	3.6	46.83	28.3	5.31	28.3	
				Bottom	54.5	57.40	35.1	3.36	28.9	
9/28/2004	6	Freeport	Inshore	**Surface**	3.6	48.22	28.8	5.6	29	
				Bottom	55.5	54.90	33.4	3.92	29	
9/28/2004	7	Freeport	On Ridge	**Surface**	3.6	47.76	28.5	5.82	28.8	1-2 ft
				Bottom	54	56.50	34.5	3.66	29	
9/29/2004	8	Freeport	On Ridge	**Surface**	3.6	45.81	27.9	5.59	27.9	
				Bottom	52.5	58	35.5	3.72	29	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
9/29/2004	9	Freeport	On Ridge	**Surface**	3.6	45.95	28	5.25	27.9	
				Bottom	51.5	57.5	35.2	3.41	28.8	
9/29/2004	10	Freeport	On Ridge	**Surface**	3.6	46.25	28.2	5.5	27.9	
				Bottom	49.5	54.2	32.8	3.6	28.8	
9/29/2004	11	Freeport	On Ridge	**Surface**	3.6	46.82	28.2	5.8	27.9	1-2 ft
				Bottom	50.5	58.4	35.8	3.55	28.9	
9/28/2004	12	Freeport	On Ridge	**Surface**	3.6	47.18	28.4	5.77	28.6	
				Bottom	52.5	56	34.1	3.73	29.1	
9/28/2004	13	Freeport	Off Ridge	**Surface**	3.6	46.89	28.3	5.7	28.4	
				Bottom	60	57	34.7	3.9	29.1	
9/29/2004	14	Freeport	Off Ridge	**Surface**	3.6	46.52	28.3	5.5	28.1	<2 ft
				Bottom	54	58.6	35.9	4.16	29	
9/29/2004	15	Freeport	Off Ridge	**Surface**	3.6	46.48	28.3	5.45	28	
				Bottom	51.5	57.5	35.2	3.39	28.8	
9/29/2004	16	Freeport	Off Ridge	**Surface**	3.6	45.85	27.9	5.56	27.9	
				Bottom	56.5	59.8	36.1	4.2	29	
9/29/2004	17	Freeport	Off Ridge	**Surface**	3.6	46.03	28	5.33	28	
				Bottom	55	58.5	35.8	3.9	29	

Date	Site #	Bank	Habitat		Depth (m)	Conductivity (mS/cm)	Salinity (ppt)	DO (mg/L)	Water Temp (oC)	Seas (ft)
9/28/2004	18	Freeport	Off Ridge	**Surface**	3.6	47.73	28.5	5.98	29	
				Bottom	55	56.70	34.6	3.81	29	
9/28/2004	19	Freeport	Offshore	**Surface**	3.6	44	28.3	5.56	28.3	
				Bottom	66	57.8	35.4	4.6	29	
9/28/2004	20	Freeport	Offshore	**Surface**	3.6	47.62	28.4	5.56	28.9	
				Bottom	69	50.40	35.7	4.44	29	
9/28/2004	21	Freeport	Offshore	**Surface**	3.6	47.53	28.4	5.76	28.8	
				Bottom	69	58.4	35.8	4.61/4.41	29	
9/28/2004	22	Freeport	Offshore	**Surface**	3.6	47.62	28.5	5.49	28.9	
				Bottom	70	58.6	35.9	4.73/4.57	29	
9/28/2004	23	Freeport	Offshore	**Surface**	3.6	47.07	28.2	5.72	28.7	
				Bottom	70.5	59	36.1	4.91/4.79	29.1	
9/28/2004	24	Freeport	Offshore	**Surface**	3.6	46.5	28.2	5.7	28.1	2 ft
				Bottom	65	58	35.6	4	28.9	

VITA

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