Packery Channel Pre- and Post-Opening – Fisheries Recruitment Project (Plankton)

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Introduction

Packery Channel is a tidal inlet through Mustang Island connecting the Gulf of Mexico to the upper portion of the Laguna Madre. In the past, this pass was a natural inlet that was open to the Gulf of Mexico for short periods of time following tropical cyclones and occasionally over-washed by very high astronomical tides. After the Aransas Pass Ship Channel was completed at the northern end of Mustang Island in 1912, Packery Channel silted in completely.

There has been considerable local interest in reopening the pass for many years and federal funding for the project was finally obtained in 2003 as a component of a beach erosion control project for North Padre Island. Construction began in late 2003 with completion scheduled for the fall of 2006. The plan was to dredge essentially all of the channel, with the exception of a sand plug at the beach line, and finish construction of the jetties before finally opening the inlet. However, the storm surge from Hurricane Emily breached the inlet on 22 July 2006 and created a permanent, albeit shallow, opening to the Gulf.

Many of the commercially and recreationally important fish and invertebrate species in the Upper Laguna Madre and Corpus Christi Bay have a life cycle where adults spawn in the coastal ocean and their eggs, larvae, or juveniles recruit to the bay system through the tidal inlets. For many of these species, only the juvenile stages reside in the estuary, with the adults living offshore and only occasionally entering the estuary. With the opening of Packery Channel, a new permanent means of ingress to the local estuarine system will be made available to these estuarine dependent marine species. This should result in more fisheries productivity from habitats adjacent to the inlet that are currently isolated from other passes and potentially underutilized as nursery habitat. The purpose of this project is to determine the impact of opening Packery Channel on fish and crustacean populations in the vicinity of the pass.

Study Area

The study area (Fig. 1) is within an estuarine system located between the northern tip of the Upper Laguna Madre and the southeastern corner of Corpus Christi Bay; Packery Channel is situated in the approximate middle of the site. In addition to the Packery Channel tidal inlet, the Intracoastal Waterway and several minor channels transect the study area.

Water flow rates (the primary determinant of larval fish advection within the estuary) are higher in the channels and previous ichthyoplankton studies in this area, and throughout the Laguna Madre, have shown that the highest densities of all fish larvae are typically found in the ICWW compared to densities of larvae found over the shallow seagrass flats. Seven sample sites for monitoring ichthyoplankton immigration were established in the Packery channel proper, in the Intracoastal Waterway (ICWW), and in Humble Channel (Fig. 1).

Materials and Methods

Samples were taken before and after Packery Channel opened. Pre-opening samples were collected on 7 Feb 05, 30 Mar 05, and 7 Jun 05. Post-opening sampling were collected on 19 Aug 05, 19 Oct 05, 30 Nov 05 and 2 March 06. Collections were made at 7 stations with 3 replicates at each one, although only 4 sites were sampled on 30 Mar 05 because of equipment problems. Two stations were located north of Packery Channel in Corpus Christi Bay (A) and the ICWW (B), one station was inside Packery Channel (C), one due east of Packery Channel in Humble Channel (D), and 3 were south of Packery Channel in the ICWW (E, F, G).

Collections were taken with a 1 m, 500 micron mesh net mounted on an epibenthic sled set to fish 20 cm off the bottom. A net mounted flowmeter recorded water volume filtered. Samples were preserved in 5% formalin, and then later sorted to species or to the lowest taxonomic level possible. In some instances the condition and/or pigmentation of the specimen negated specific identification. At other times there were not sufficient references to identify to species; this was particularly true with the family Gobiidae. Once sorted, each taxa was enumerated.

Environmental conditions were measured and recorded using a YSI 650 MDS data-logger and 6950 Datasonde. Parameters measured were temperature, salinity, dissolved oxygen, pH and depth, except on the last trip when we only recorded salinity because of instrument failure.

The intent was for this series of samples to serve as pre-opening control samples for comparison to later, post-opening, samples. However, the pre-mature breaching of the sand plug by Hurricane Emily complicated matters. Ichthyoplankton samples target only the youngest developmental stages of most species, generally individuals less than a month old. Due to the highly seasonal nature of the spawning period of most species, larvae of a given species are typically available for capture for only a few months out of the year. Therefore, any temporal comparison such as before and after opening the inlet must compare similar months, or at least similar seasons. This limits us to making direct comparisons only between the February and March 2005 samples with the March 2006 samples. The other collections are important, however, for comparison with future samples and for assessing the spatial distribution of individuals within the study area. The comparison of spatial distribution before and after the inlet was opened can be as instructive as comparing temporal distribution in assessing the effects of the inlet on larval immigration.

Results

We captured over 37,000 individual larvae in the study (Table 1), although almost 25,000 of those (65.2%) were *Anchoa* sp., probably bay anchovy, *Anchoa mitchilli*. Anchovies typically dominate ichthyoplankton catches, not only in the Laguna Madre (Holt et al 1990, Holt and Pratt 1998), but in all Texas bay systems. Unidentified gobies were the second most abundant organisms (15.8%) but this category is probably composed of several species. Among the recreationally or commercially important species, penaeid shrimp (mostly brown shrimp, *Farfantepenaeus aztecus*) comprised about 10% (3871 ind.) of the catch, Atlantic croaker (*Micropogonais undulatus*) comprised about 1% (483 ind.) and spotted seatrout (*Cynoscion nebulosus*) about 0.5%

(224 ind.). A few species were conspicuous by their absence, particularly red drum (Sciaenops ocellatus) with only 1 individual and southern flounder (*Paralichthys lithostigma*) which was not taken in the study.

In comparing the collections from February and March 2005 to those from March 2006, it can be seen that several species were taken primarily, or even exclusively, in 2005 while the channel was still closed. These include anchovies, gobies, and Gulf menhaden (*Brevoortia patronus*), (Figs. 2-4 respectively). In contrast, two species, pipefish (Signathidae) and silversides (Antherinidae), were much more abundant in March 2006 when the pass was open (Figs 5-6).

The temporal distribution of two other species is of interest even though they do not fit the clear March to March comparison. Atlantic croaker and Penaeid shrimp (primarily brown shrimp) are both offshore spawned species whose larval or early juvenile stages immigrate through the tidal inlets to reach the estuarine nursery grounds and both have relatively long immigration periods. For both species, but especially for Atlantic croaker, densities were much higher in collections taken after the inlet was breached (Figs 7-8). Interestingly, the highest densities of Atlantic croaker were not at the inlet station itself but at station E in the ICWW, well south of the connection between the inlet and the ICWW. Differences between pre- and post-opening densities of shrimp postlarvae were not as great as for Atlantic croaker but more in line with expectations, post opening densities were highest in the inlet and at adjacent stations and lowest at stations most distant from the inlet.

The distribution of two other species warrants consideration. Spotted seatrout and silver perch (*Bairdiella chrysoura*) spawn in the spring and summer and both spawn primarily within the estuary and thus are not dependent on the inlet for access to estuarine nursery grounds. Spotted seatrout larvae were relatively widespread, at low abundance, both before and after the inlet was breached. The only anomalous occurrence was the very high density at station G in August (Fig. 9). Silver perch larvae were taken in high numbers in the March 2005 collections at both the Corpus Christi Bay site (station A) and in the ICWW and the not-yet-open Packery Channel (stations E-G were not sampled in the March 2005 collections). Silver perch were found at essentially the same stations in the June 2005 collections but at much lower density (Fig. 10).

Discussion and Conclusions

The premature breaching of the sand plug separating Packery Channel from the Gulf of Mexico substantially complicated the assessment of pre-opening and post-opening conditions for larval fish and shrimps in the Packery Channel area. The only direct comparison that can be made is between collections taken in March of 2005 and 2006. This is a period of relatively low density and diversity of estuarine dependent marine species (estuarine dependent), i.e those species that will likely benefit most from the open inlet since they are spawned offshore and recruit to estuarine nursery sites through the inlet. The only estuarine dependent species caught in relatively high density in the March samples was Gulf menhaden and they were near the end of their seasonal recruitment period. The reason for the high density of Gulf menhaden in the pre-open collections verses the post-open collections is not clear. However, with the exception of silversides sp. and pipefish, the March 2006 collections were quite depleted in all species. This may have been due to the collections being taken during a period of low tides.

Only two estuarine dependent species showed density distribution changes suggestive of inlet influence. Atlantic croaker was two orders of magnitude more abundant in the study area in collections when the inlet was open than when it was closed but the highest density was not in the inlet itself. It would have be unlikely for larval stages of Atlantic croaker to make it to the study area from the Aransas Pass inlet when immigration through Packery Channel was not possible. This change in distribution is precisely what would be expected from the inlet being open for immigration of offshore spawned larvae. Penaeid shrimp postlarvae also showed a substantial increase in mean density in post-opening collections and the highest density was in the inlet.

One possible consequence of opening the inlet to the Gulf is the disruption of ecological processes extant when the inlet was closed. Spawning activity of spotted seatrout and silver perch fall under this possibility. Spotted seatrout larvae were relatively wide spread both before and after the inlet was opened. The data for silver perch, however, suggest such possible disruptive effects since larval density was an order of magnitude lower after the inlet was opened. However, silver perch is primarily a spring and early summer spawner and the post opening collections were in late summer so further data are required to address this possibility.

There is little data on larval fish densities in this area. Holt et al 1990 took ichthyoplankton samples in the same area as this study and compared larval densities with collections taken at the same time from the area around Yarbrough Pass in the Upper Laguna Madre and in the Lower Laguna Madre from the Land Cut to Port Mansfield. In general, the lowest densities of most fish and shrimp larvae were seen in the region of Packery Channel. The highest diversity and typically the highest average densities of most species were seen in the vicinity of the Port Mansfield inlet, with intermediate densities in the remainder of the Lower Laguna Madre and the Yarbrough Pass area. Of course, at that time, Packery Channel was closed. Additional research is needed to determine whether a fully open and functional Packery Channel will provide similar opportunities for immigration and settlement of estuarine dependent marine species as was documented at the Port Mansfield inlet.

Literature Cited

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Holt, S. A., and C. M. Pratt. 1998. Effects of a persistent brown tide on larval fishes in the Laguna Madre, Texas. U.S Fish and Wildlife Service, Corpus Christi, Texas.

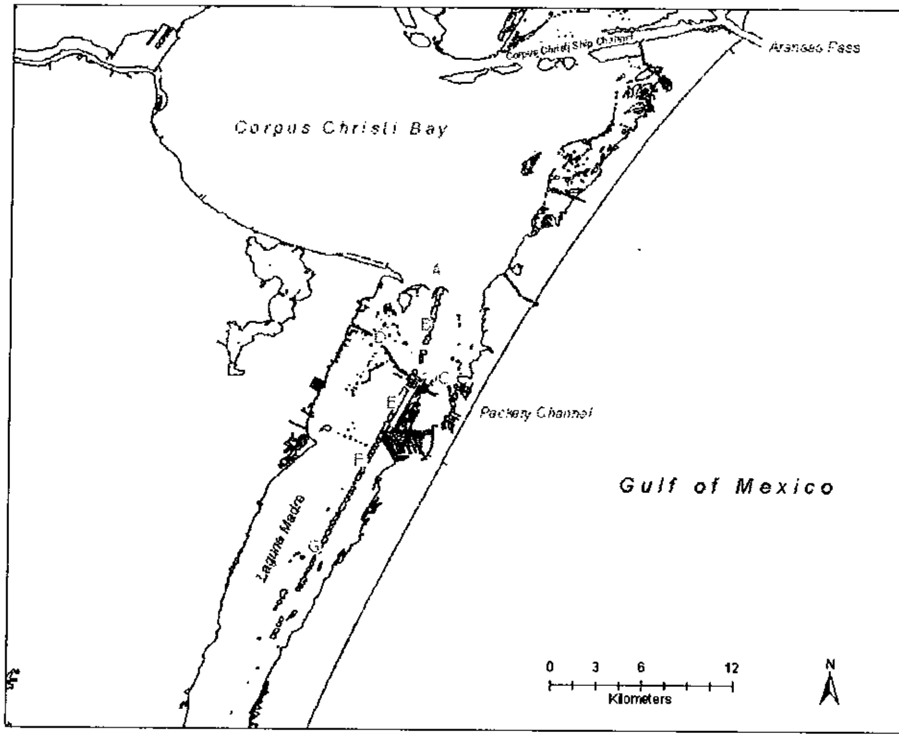

Figure 1. Map of Packery channel study area showing the location of ichthyoplankton sample sites.

Common name/ Taxa	Total catch	Mean density (No./1000 m3)	% rank in abundance	Location of catch (station)	Month of catch	Season
Anchovy *Anchoa sp.*	24554	656.79	65.216	A B C D E F G	2 3 6 8 10 11	W Sp Su F
Goby *Gobiidae*	5956	153.75	15.819	A B C D E F G	3 6 8 10	Sp Su F
Penaeid shrimp (Post larval) *Penaeidae*	3871	108.02	10.282	A B C D E F G	2 3 6 8 10 11	W Sp Su F
Pipefish *Syngnathidae*	629	17.32	1.671	A B C D E F G	2 3 6 8 10 11	W Sp Su F
Atlantic croaker *Micropogonias undulat*	483	26.34	1.283	B C D E F G	2 3 10 11	W Sp F
Green goby *Microgobius thalassinus*	395	11.96	1.049	A B C D E F G	6 10 11	Su F W
Naked goby *Gobiosoma bosc*	391	11.20	1.039	B C E F	10	F
Spotted seatrout *Cynoscion nebulosus*	224	5.01	0.595	A B C D E F G	3 6 8	Sp Su
Gulf menhaden *Brevoortia patronus*	180	4.92	0.478	A B C D E F G	2 3	W Sp
Silver perch *Bairdiells chrysoura*	159	3.91	0.422	A B C E	3 6 8	Sp Su
Herring *Clupeidae*	133	3.73	0.353	A B C E F G	8 10 11	Su F W
Silversides *Atherinidae*	130	3.22	0.345	A B C E F G	3	Sp
Feather blenny *Hypsoblennius hentz*	75	1.84	0.199	A B C D E F G	3 6 8	Sp Su
Blue crab megalops *Callinectes sapidu*	73	1.80	0.194	A B C F G	3 6	Sp Su
Spot *Leiostomus xanthurus*	62	1.62	0.165	A C D	3	Sp
Skilletfish *Gobiesox strumosus*	51	1.23	0.135	A B C D E F G	3 6	Sp Su
Hogchoker *Trinectes maculatus*	47	1.37	0.125	B C F	8	Su
Pinfish *Lagadon rhomboides*	29	0.82	0.077	A B C	2 3 11	W Sp F
Blenny *Blenniidae*	28	0.73	0.074	A B C	3 8 10 11	W Sp Su F
Ladyfish *Elops saurus*	28	0.72	0.074	B C D	3 6 11	Sp Su W
Sand seatrout *Cynoscion arenarius*	24	0.71	0.064	A C D	3 8	Sp Su
Darter goby *Gobionellus boleosoma*	20	0.73	0.053	C E F	3 11	Sp W
Whiting *Menticirrhus sp.*	20	0.58	0.053	A B C G	3 8 10	Sp Su F
Black drum *Pogonias cromis*	18	0.44	0.048	A B C	3	Sp
Gulf black sea bass *Centropristis striat*	17	0.51	0.045	C	8	Su
Mullet *Mugilidae*	14	0.35	0.037	C	3	Sp
Seahorse *Hippocampus sp.*	10	0.27	0.027	A C E F G	2 6 8 10 11	W Sp Su F
Drum *Sciaenidae*	8	0.20	0.021	A C	3	Sp
Sheepshead *Archosargus probatoceph*	8	0.18	0.021	C D	3	Sp
Lizardfish *Synodontidae*	3	0.06	0.008	C D	3	Sp
Halfbeak *Exocotetidae*	2	0.04	0.005	F G	8	Su
Leatherjacket *Oligoplites saurus*	2	0.05	0.005	B C	6 8	Su
Bay whiff *Citharichthys spilopterus*	1	0.02	0.003	C	11	W
Gulf toadfish *Opsanus beta*	1	0.02	0.003	D	6	Su
Jack *Carangidae*	1	0.02	0.003	G	3	Sp
Red drum *Scianops ocellatus*	1	0.03	0.003	C	11	W
Violet goby *Gobioides broussoneti*	1	0.04	0.003	C	11	W
Worm eel *Ophichthidae*	1	0.03	0.003	C	8	Su

Table 1. Species and taxa collected in ichthyoplankton collections in the Packery Channel area from February 2005 through March 2006.

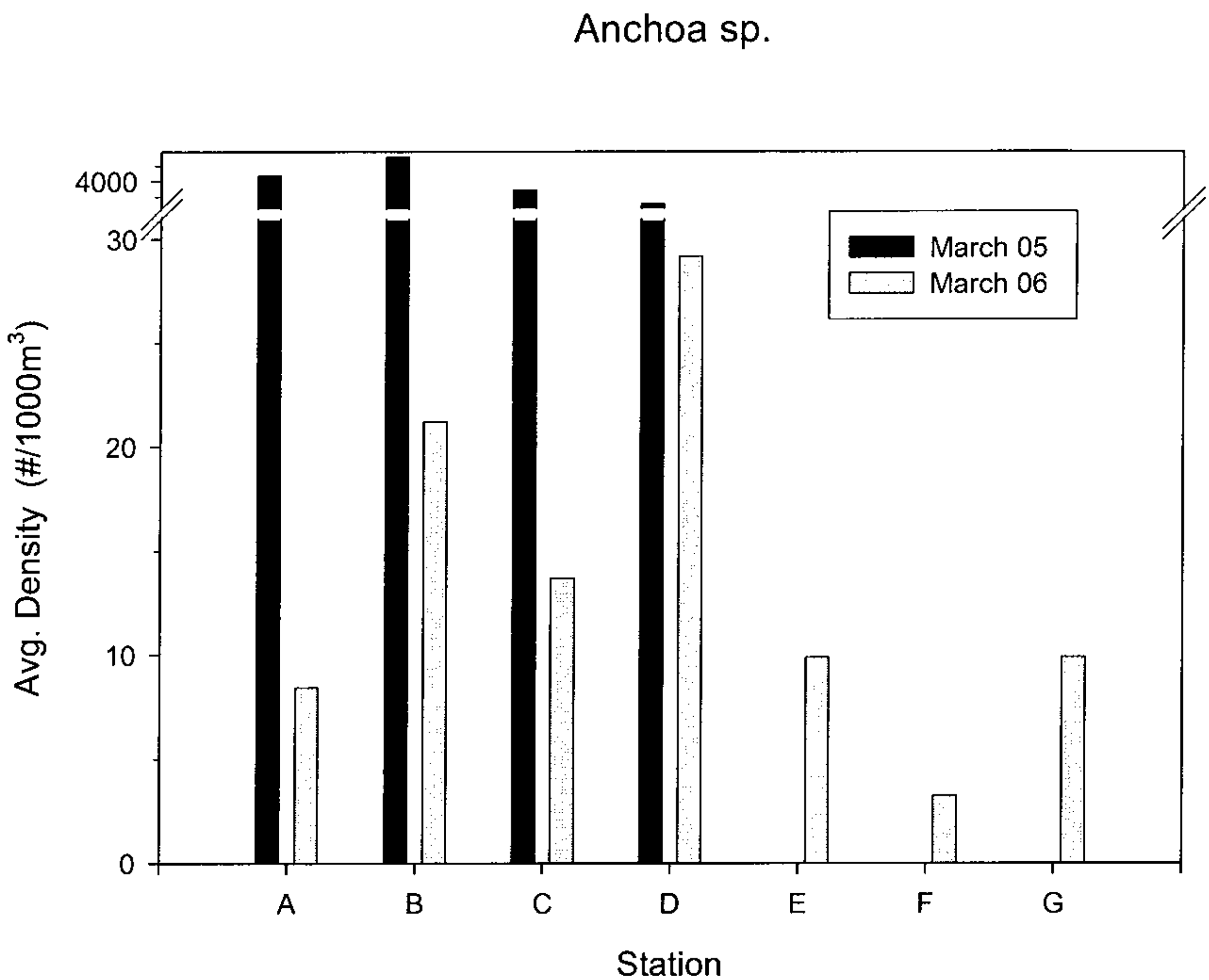

Figure 2. Comparison of mean catch rates for *Anchoa sp.* larvae at each station March 2005 (Pre-opening) and March 2006 (Post-opening) in the Packery Channel study site.

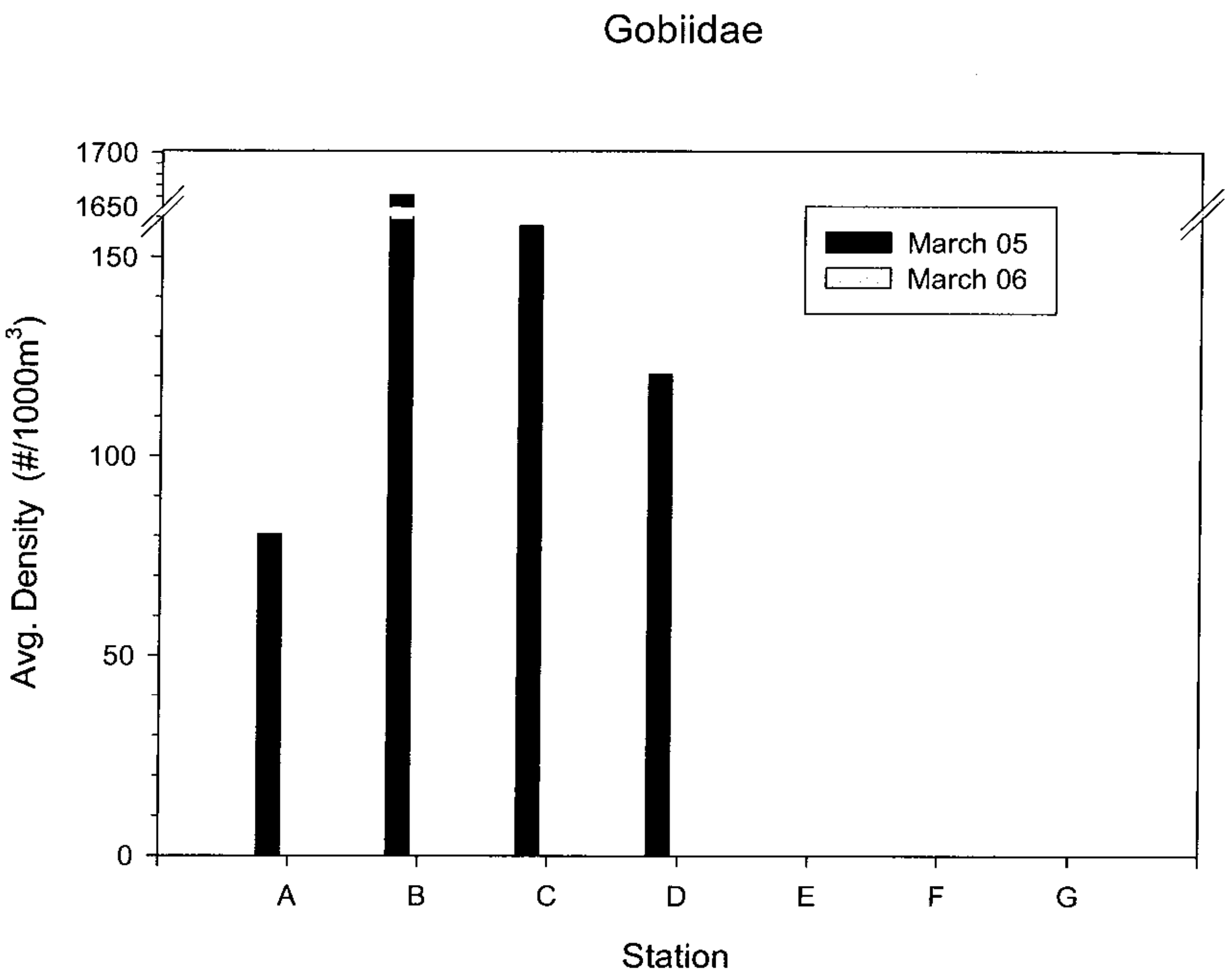

Figure 3. Comparison of mean catch rates for *Gobiidae* larvae at each station March 2005 (Pre-opening) and March 2006 (Post-opening) in the Packery Channel study site.

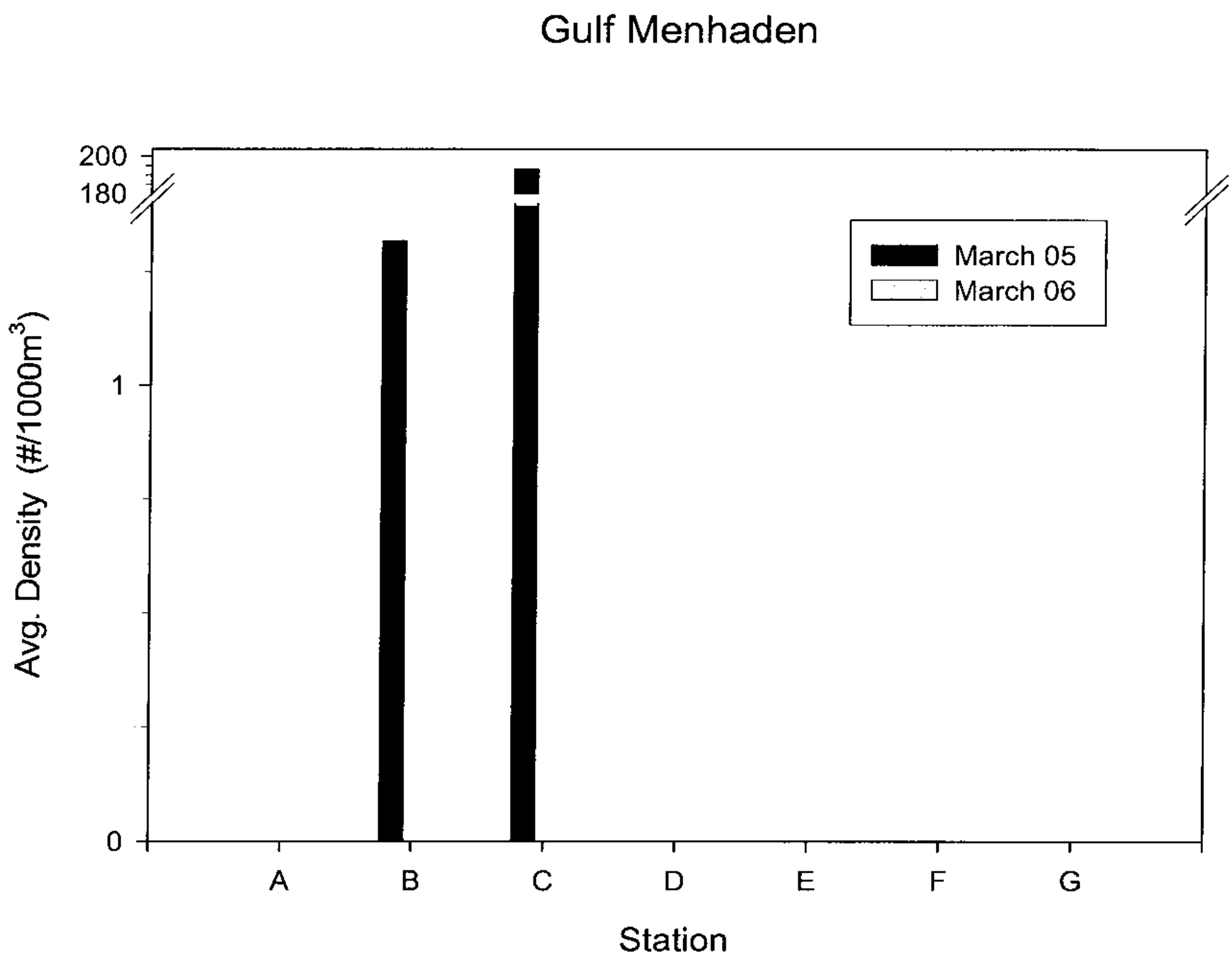

Figure 4. Comparison of mean catch rates for Gulf menhaden larvae at each station March 2005 (Pre-opening) and March 2006 (Post-opening) in the Packery Channel study site.

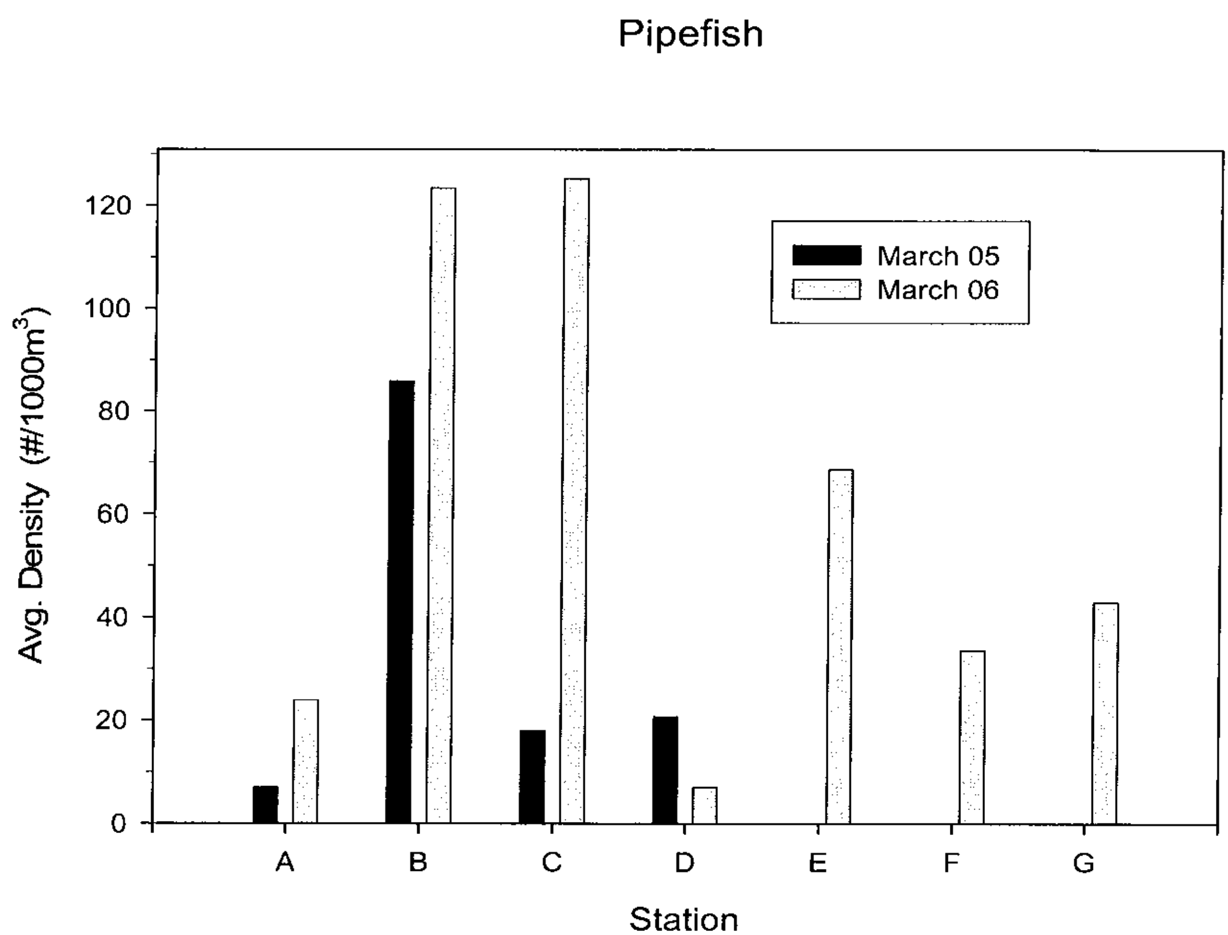

Figure 5. Comparison of mean catch rates for pipefish larvae at each station March 2005 (Pre-opening) and March 2006 (Post-opening) in the Packery Channel study site.

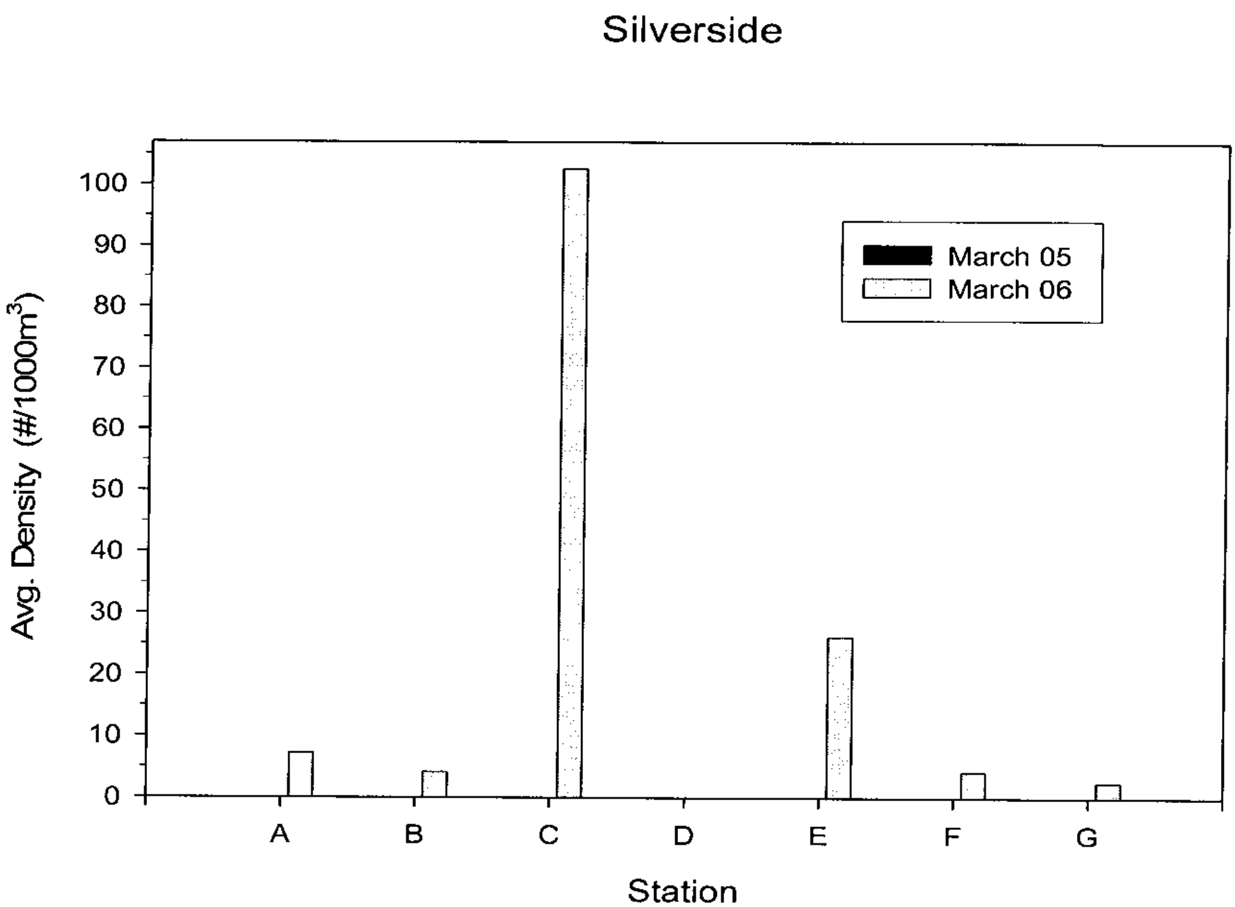

Figure 6. Comparison of mean catch rates for silverside larvae at each station March 2005 (Pre-opening) and March 2006 (Post-opening) in the Packery Channel study site.

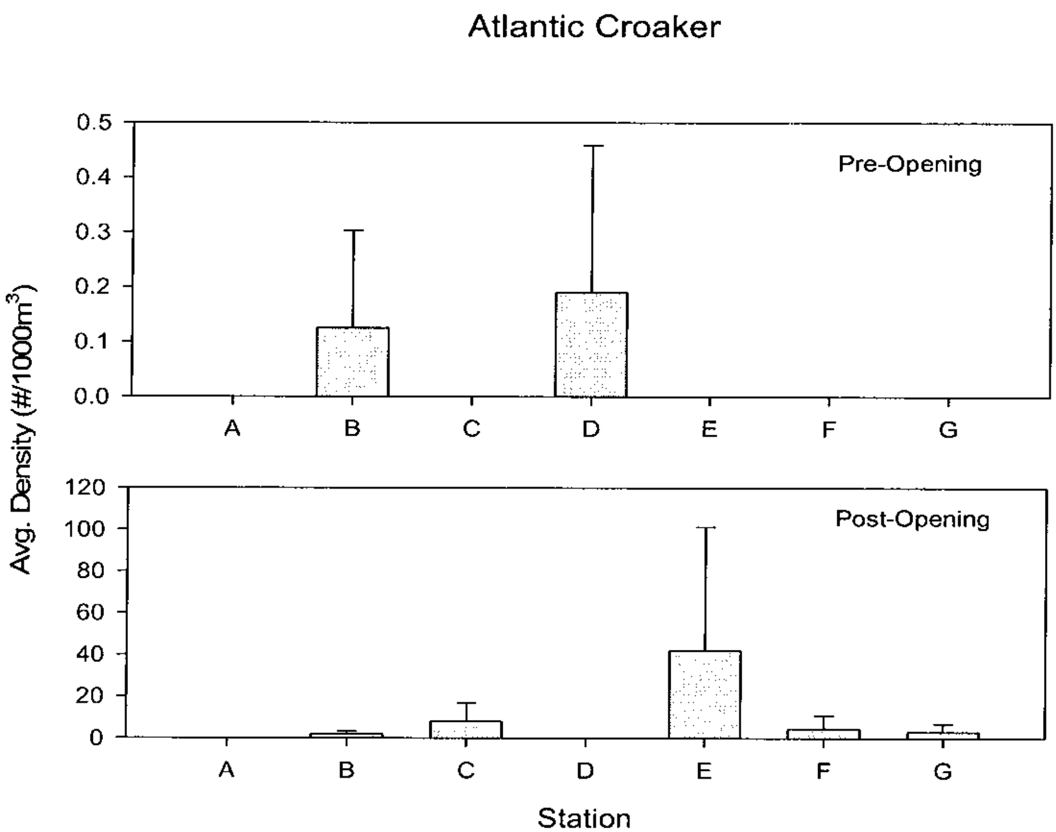

Figure 7. Comparison of spatial distribution of Atlantic croaker in collections taken prior to and after the inlet was breached by Hurricane Emily in July 2005.

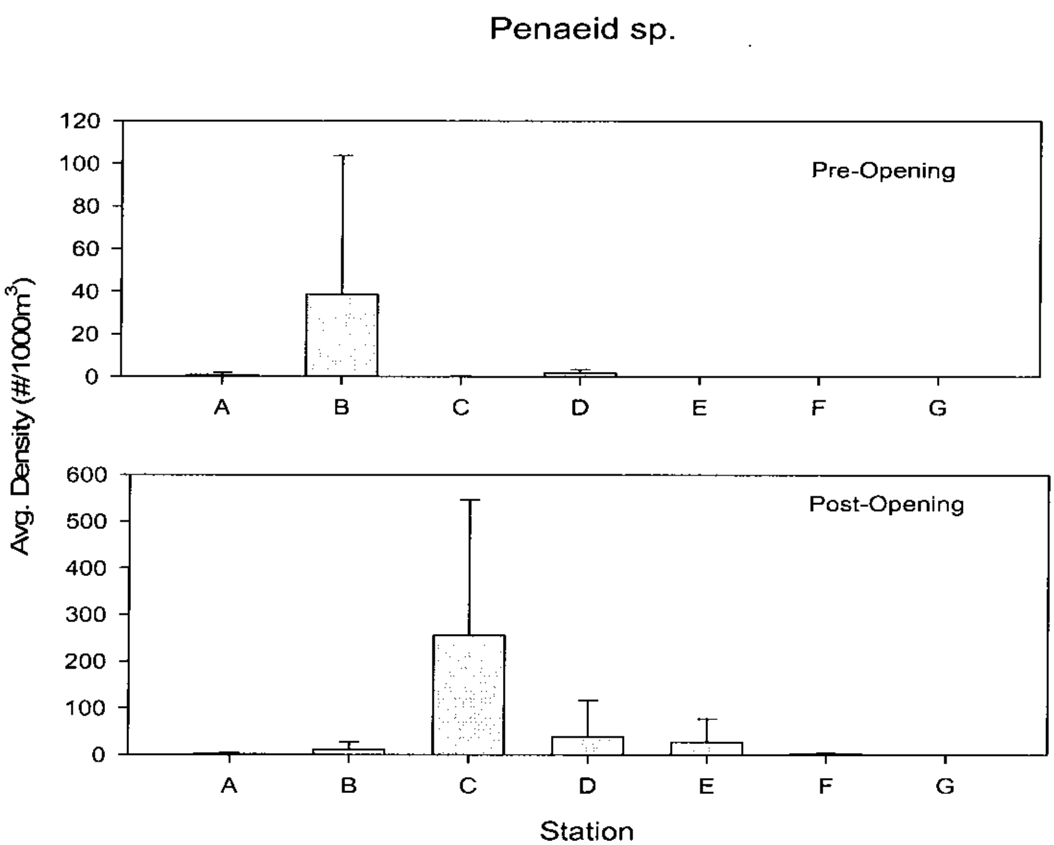

Figure 8. Comparison of spatial distribution of Penaeid sp. in collections taken prior to and after the inlet was breached by Hurricane Emily in July 2005.

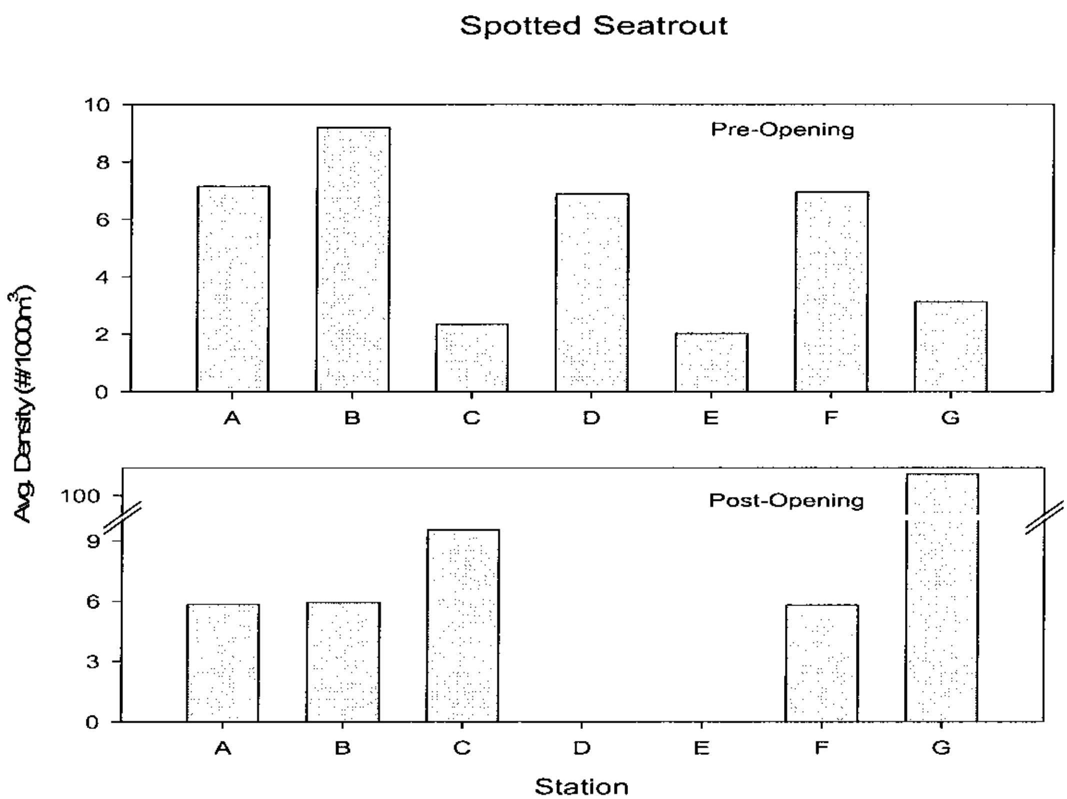

Figure 9. Comparison of spatial distribution of spotted seatrout in collections taken prior to and after the inlet was breached by Hurricane Emily in July 2005.

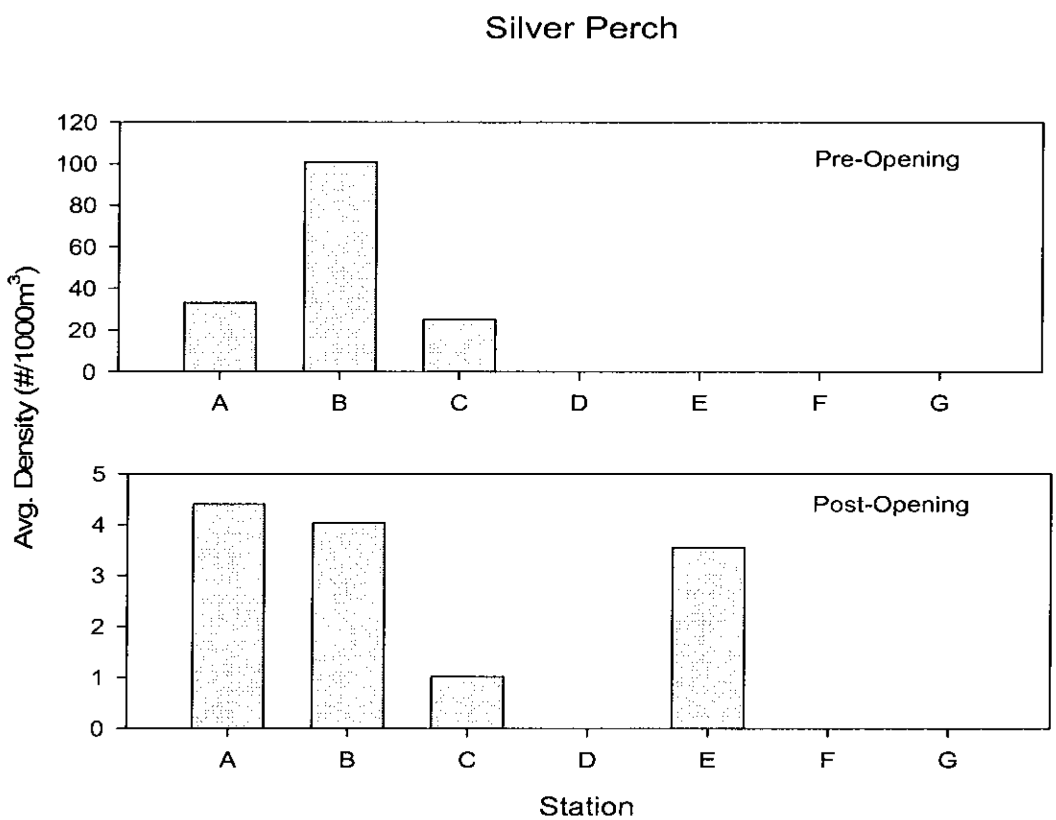

Figure 10. Comparison of spatial distribution of silver perch in collections taken prior to and after the inlet was breached by Hurricane Emily in July 2005.

0534

Jim Bowman

From: Scott Holt [sholt@utmsi.utexas.edu]
Sent: Monday, August 21, 2006 11:29 AM
To: jbowman@cbbep.org
Cc: Gregory Stunz
Subject: Re: Reports

Jim,

Here is my final report on the Year I Packery Channel Project. Let me know if you need anything else (i.e. do you need hard copies). We have not discussed the submission of data to a centralize database. Do we need to address that now or wait until the completion of the follow-up study?

For the final report on the year II/III work, Greg and I will produce a combined report that integrates the ichthyoplankton and nekton results.

Scott

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List on
It's done

Coastal Bend Bays and Estuaries Program, Inc.

I. Contractor Quarterly Report

A. Project Name: Packery Channel - Pre and Post Opening - Fisheries Recruitment Project (Ichthyoplankton)

B. Scott A. Holt

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D. 3rd Quarter Report for 2006

E. 09/15/2006

F. Submitted to:

Coastal Bend Bays and Estuaries Program
1305 N. Shoreline Blvd., Suite 205
Corpus Christi, TX 78401

II. Tasks completed:

The task for the third quarter of 2006 was to complete and submit the final report for this project

III. Status of Tasks in Progress:

The final report for the study was submitted on 08/18/2006

IV. Plan for Next Quarter:

The project is finished

V. Adherence to Project Timeline:

There are no delays involved with this project.

A. Explanation of Delay - N/A

B. Anticipated Delay
There are no anticipated delays .