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APPENDIX D

EVALUATION OF SEAMAP ICHTHYOPLANKTON DATA (FISH EGGS AND LARVAE) FROM THE WATERS AROUND WEST CAMERON BLOCKS 213 AND 183

1.0 INTRODUCTION

This appendix to the Gulf Landing Environmental Report (ER) was developed as a supplemental submission. It was specifically developed to address a request identified during the initial completeness review by the U.S. Coast Guard as follows:

> *"NOAA expressed concern that the environmental review data, while containing qualitative data for the Northern Gulf of Mexico, is not applicable for the specific site proposed for the location of the deepwater port. Moreover, the NOAA regional office in Baton Rouge, LA, considers it essential that you quantify the entrainment mortality of eggs and larvae of marine fishery species, as accurately as possible, at the proposed port sites. NOAA would prefer that you provide depth-specific data on the densities of fish eggs and larvae at each site; however, we appreciate the realities that this information may have to be obtained over a considerable period of time (i.e., at least one year). In order to address this issue, it is recommended that your environmental staff examine the NOAA Sea Map data set, which may contain much of the pertinent information required to complete your environmental review. With regard to depth-specific data, you may address this issue by indicating what information is readily available, providing some qualitative discussion of the issue and problems associated with timely collection of such data, and proposing to obtain information as part of an environmental monitoring program."*

Gulf Landing has reviewed the Southeast Area Monitoring and Assessment Program (SEAMAP) data and completed a reassessment of its potential impact within this appendix.

2.0 AVAILABLE ICHTHYOPLANKTON DATA

There are limited site-specific or depth-stratified ichthyoplankton data available from either West Cameron Block 213, the preferred location for the Gulf Landing LNG terminal, or West Cameron Block 183, the potential alternative location for the terminal. Plankton by its very nature is at the mercy of winds and currents in open ocean situations. Although some members of the ichthyoplankton can swim, planktonic populations tend to vary greatly over rather short periods of time in the open ocean. Collecting meaningful site-specific and/or depth-stratified data on ichthyoplanktonic populations at any specific location would require, at a minimum, seasonal sampling over a period of several years.

2.1 SEAMAP DATA

The SEAMAP project is an ongoing database being compiled by a State/Federal/university program. The purpose of this program is the collection and dissemination of fishery-independent information, or information collected without direct reliance on statistics reported by commercial or recreational fishermen, in the U.S. waters of the Gulf of Mexico (GOM). The SEAMAP program began in March 1981 and continues through the present.

SEAMAP plankton samples are taken at stations arranged in a systematic grid across the entire northern GOM. Stations are spaced at a minimum of 30 nmi (1/2 degree) and are usually sampled in the spring (April-May) and fall (September-October). Plankton sampling gear consists of standard 61-cm bongo nets for water column sampling and a 2 m x 1 m neuston net for air/sea interface sampling. Mesh size on the bongos is 0.333 mm, while mesh size on the neuston net is 0.948 mm.

A plankton sampling station may consist of both an oblique bongo net tow through the water column and a surface neuston tow, or just a surface neuston tow alone. At bongo net stations, the standard oblique tow consists of lowering the net to a depth 2 m above the bottom at a payout speed of 50 m/min, allowing a 30-s settling time, then retrieving the net at a vertical rate of 20 m/min, while the vessel maintains a speed of 1.5 kn (maintaining a wire angle of 45^{o}). Neuston tows are made with the 2-m diameter net half submerged for 10 min at a vessel speed of 1.5 kn. No flow meters are attached to the neuston nets, making this data set impossible to quantify accurately. For this reason only, data collected in bongo net tows are presented in this review.

Because the SEAMAP bongo net tows are oblique through the entire water column, no inference about ichthyoplankton depth stratification can be obtained from these data. Studies in shallower water (10-m [30-ft] depths) areas inshore of the project site where depth stratified sampling did occur have indicated concentrations of zooplankton and fish eggs to be between four and five times higher at the surface than at the bottom (Wolff and Wormuth, 1984).

For the purposes of this review, the SEAMAP plankton data set for the entire GOM was downloaded from ftp.mslabs.noaa.gov/pub/seamap/gulf/plankton.zip, the NOAA SEAMAP Internet FTP site. Estimates of the potential entrainment of fish larvae and fish eggs during the operation of a seawater intake system such as the one proposed for Gulf Landing, were developed using SEAMAP stations within a 30-min (30 nmi) box around the proposed and alternative project sites (**Figure 1**). These stations were retrieved from the master data set using MS Access 2000, and their contents were converted into MS Excel spreadsheet format for analysis. Due to the SEAMAP sampling strategy, stations within 21 nmi of Block 213 were assessed for estimating impacts at the preferred location, and stations within 25 nmi of Block 183 were assessed for estimating impacts at the alternative location (**Figure 1**). Total concentrations of ichthyoplankton within the SEAMAP 30-min (30 nmi) by 30-min (30 nmi) area also were evaluated.

NOAA has provided an estimate of 11,587 fish eggs per million gallons of water based on SEAMAP data (Nancy Thompson/Alex Chester memorandum to Roy Crabtree, Regional Administrator July 11, 2003). However, although eggs are collected and sorted from SEAMAP samples, they are not cataloged into the SEAMAP system. SEAMAP has thousands of eggs, but they do not have any way to access or provide station specific data (Kim Williams, manager NOAA SEAMAP sample archives St. Petersburg, Florida, personal communication). We have utilized the NOAA estimate of 11,587 fish eggs per million gallons of water in **Table 1** of this response. The SEAMAP data are collected in the spring and fall when spawning and recruitment of fish species may be seasonally high.

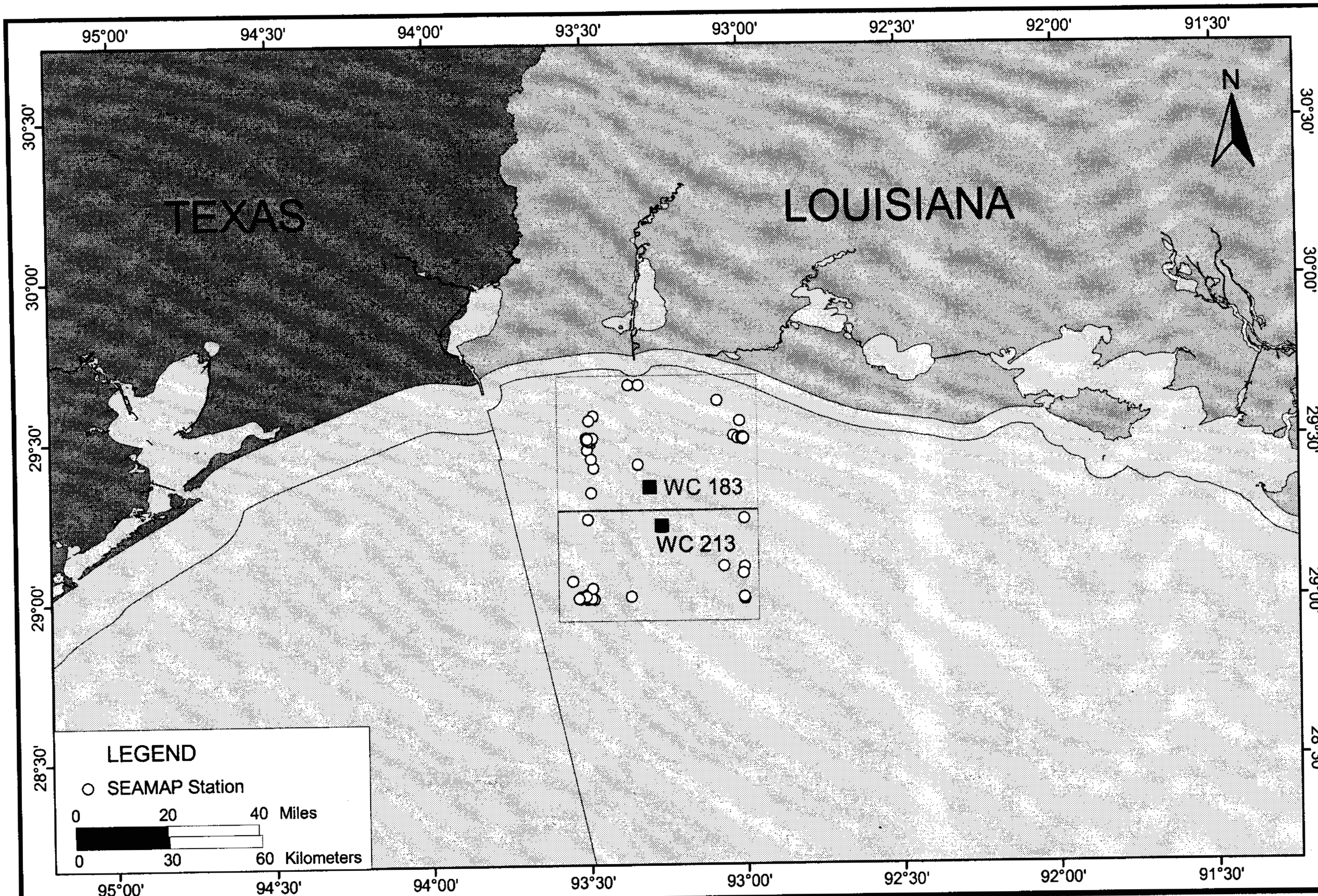

Figure 1. SEAMAP sampling stations evaluated relative to the preferred (West Cameron [WC] 213) and alternative (WC 183) sites proposed for the Gulf Landing.

2.2 SHAW ET AL. (2002) DATA

In order to develop the quantitative estimates of potential marine larval fish entrainment presented in the Gulf Landing LNG Terminal ER, we selected data from the MMS OCS Study 2002-077, "Offshore Petroleum Platforms: Functional Significance for Larval Fish Across Longitudinal and Latitudinal Gradients" by Richard F. Shaw et al. (2002). We made this decision as it may be argued that the Shaw et al. (2002) data set represents the best data available to assess potential entrainment impacts from offshore operations such as those proposed by Gulf Landing.

The Shaw et al. (2002) data were collected on offshore structures (petroleum platforms). Offshore structures represent hard substrate, or "vertical benthos" imposed into an otherwise featureless pelagic environment. Offshore structures of all types are thought to enhance the production of habitat-limited species by providing additional spawning habitat and nursery and recruitment area (Shaw et al., 2002). For this reason, we believe data collected around structures are more appropriate for estimating ichthyoplankton populations likely to be present around the Gulf Landing facilities once they are constructed. Sampling periods in the Shaw et al. (2002) study were for two consecutive nights at approximately 14-day intervals consistent with new and full moon periods. These moon-phase sampling periods were targeted to correspond with peak spawning or peak recruitment periods for benthic and pelagic fishes. Collections were made using a near surface modified quatrefoil light trap, and a near surface, passively fished 60-cm diameter plankton net with a mesh size of 333 µm, and sampling was continued over a calendar period of 9 months.

From these data, the quantitative estimates of potential larval fish entrainment presented in Table 4.14 and discussed on pages 4-32 through 4-35 of the Environmental Consequences section (Section 4.0) of the Gulf Landing ER were developed. These data were also used to compare potential larval fish entrainment under various seawater intake volume scenarios presented in Table 2.3 on page 2-25 of the Alternatives section of the ER.

2.3 COMPARISON OF DATA

Table 1 presents a summary of the results of this SEAMAP data analysis in terms of the potential entrainment of fish eggs and larvae for the preferred (West Cameron Block 213) and alternative (West Cameron Block 183) Gulf Landing locations compared to the larval fish entrainment estimates based on Shaw et al. (2002).

Table 1. Comparison of potential entrainment estimates for fish larvae and fish eggs based on a seawater intake of 127 million gallons per day.

Locations	Data Set		
	SEAMAP		Shaw et al. 2002
	Fish Larvae Per Day	Fish Eggs Per Day	Fish Larvae Per Day
West Cameron 213 (Preferred Alternative)	536,457	1,471,549	796,800
West Cameron 183	491,271		
Entire 30-nmi^2 SEAMAP Sampling Grid	551433		

Although there are minor variations between the estimated entrainment potential for fish larvae between the preferred location (West Cameron Block 213) and the possible alternative location in West Cameron 183, these differences are not felt to be significant. All estimates of potential entrainment presented here are based on the worst-case assumption that ichthyoplankton are distributed evenly throughout the water column. The actual entrainment potential for a near bottom intake isolated within a bottom-to-surface caisson is anticipated to be much lower than estimates developed from the full water column analysis. The Gulf Landing monitoring program has been designed to assess actual levels of entrainment and to provide data for the adjustment of the seawater intake if necessary.

The complete SEAMAP data set used to develop the potential entrainment estimates presented in **Table 1** is present in the following summary tables:

Table 2 – Summary of total larval fishes collected within 21 nmi of West Cameron Block 213 (June 1984 through July 1999);

Table 3 – Taxonomic breakdown of larval fishes collected within 21 nmi of West Cameron Block 213 (June 1984 through July 1999);

Table 4 – Summary of total larval fishes collected within 25 nmi of West Cameron Block 183 (June 1982 through September 1999);

Table 5 – Taxonomic breakdown of larval fishes collected within 25 nmi of West Cameron Block 183 (June 1982 through September 1999);

Table 6 – Summary of total larval fishes collected within the 30-nmi SEAMAP sampling grid containing both West Cameron Block 213 and West Cameron Block 183 (June 1984 through July 1999); and

2.4 DATA UNCERTAINTY AND APPLICABILITY

The objective of our analysis has been to quantitatively estimate the potential for the entrainment of fish eggs and larvae by the seawater intake system proposed for the Gulf Landing LNG facility. We have conducted this assessment using the best available data; however there are several caveats, which must be placed around these estimates. These are as follows:

1) All available ichthyoplankton data were collected either at the surface or throughout the entire water column. There are no depth specific ichthyoplankton data from the project site or in the nearby sampling stations summarized in the SEAMAP database. Nearshore data outside the project area (Wolff and Wormuth, 1984) suggest ichthyoplankton concentrations in near surface samples of four to five times greater than in near bottom samples. Our assessments of potential ichthyoplankton impacts are based on water being drawn from the entire water column. These estimates must be considered "worst case" because the actual seawater intake will be in an isolated structure near the bottom;
2) The Shaw et al. (2002) data set upon which our original quantitative impacts was based, was collected with the specific objective of collecting larval fishes at the phase of the moon when they are most abundant, that is when spawning and recruitment are at maximum levels. During other times of the

Table 2. Summary of total larval fishes collected within 21 nmi of West Cameron Block 213 (June 1984 through July 1999).

Station	Latitude	Longitude	Date	Total/m^3	Total/100 m^3
41079	29°00.00'N	93°00.00'W	6/18/1984	0.757	75.676
41242	29°06.00'N	93°00.00'W	7/13/1984	0.645	64.516
41372	29°00.00'N	93°00.00'W	8/12/1984	0.857	85.714
41374	29°15.10'N	93°00.00'W	8/12/1984	0.865	86.486
41375	29°15.10'N	93°00.00'W	8/12/1984	0.622	62.222
41386	29°00.00'N	93°30.00'W	8/13/1984	1.303	130.303
41387	29°15.00'N	93°30.00'W	8/13/1984	1.027	102.703
42855	29°00.00'N	93°00.10'W	6/22/1985	0.465	46.512
44176	29°00.10'N	93°00.00'W	6/22/1986	2.000	200.000
25	29°00.80'N	93°30.02'W	9/17/1986	1.533	153.333
45789	29°00.20'N	93°29.90'W	7/3/1987	1.524	152.381
46253	29°00.98'N	93°30.02'W	9/22/1987	0.857	85.714
48530	29°00.00'N	93°28.90'W	9/21/1988	0.808	80.769
48975	29°06.10'N	93°04.00'W	11/5/1988	0.679	67.857
50655	29°00.09'N	93°29.70'W	11/6/1989	1.065	106.452
51929	29°00.00'N	93°00.00'W	9/23/1990	0.873	87.273
53239	29°00.00'N	93°00.00'W	7/4/1991	1.178	117.808
53240	29°00.60'N	93°29.80'W	7/4/1991	1.097	109.677
93	29°00.10'N	93°00.10'W	9/10/1991	1.135	113.462
99	29°20.00'N	93°29.30'W	9/11/1991	1.155	115.493
53538	29°00.00'N	93°00.10'W	11/3/1991	0.657	65.672
54185	29°04.77'N	93°00.27'W	7/6/1992	1.889	188.889
41	29°00.00'N	93°00.00'W	9/11/1992	0.921	92.063
42	29°00.00'N	93°30.10'W	9/11/1992	0.733	73.267
54530	29°00.03'N	93°00.04'W	11/6/1992	0.582	58.228
55236	29°00.41'N	93°21.81'W	10/31/1993	1.257	125.714
28028	29°00.20'N	93°30.00'W	9/16/1994	2.000	200.000
28051	29°00.05'N	93°29.93'W	9/14/1995	1.304	130.435
145	29°00.13'N	93°29.38'W	7/6/1996	1.617	161.702
187	29°00.62'N	93°30.60'W	7/9/1997	1.520	152.000
28030	29°02.00'N	93°29.23'W	9/11/1997	1.032	103.158
28031	29°00.32'N	93°00.15'W	9/12/1997	1.944	194.444
183	29°00.51'N	93°30.43'W	7/11/1999	0.926	92.593

Summary Statistics	Total/m^3	Total/100 m^3
Mean	1.116	111.591
Standard Deviation	0.433	43.277
Standard Error	0.075	7.534
95% Confidence Interval	0.153	15.346
99% Confindence Interval	0.206	20.632
Size	33.0	33.0
Total	36.825	3682.517
Minimum	0.465	46.512
Maximum	2.000	200.000

Table 3. Taxonomic breakdown of larval fishes collected within 21 nmi of West Cameron Block 213 (June 1984 through July 1999).

Common Name	Scientific Name	Total Larvae/m^3	Percent Composition	Mean Larvae/m^3	Occurrence in Total Nos. of Samples	Percent Occurrence
Atlantic bumper	*Chloroscombrus chrysurus*	2.240	6.09	0.08	29	87.9
Tonguefish	*Symphurus*	1.852	5.04	0.06	30	90.9
Anchovy	Engraulidae	1.708	4.64	0.06	27	81.8
Atlantic thread herring	*Opisthonema oglinum*	1.268	3.45	0.07	19	57.6
Goby	Gobiidae	1.144	3.11	0.04	26	78.8
Bony fish	Unidentified fish	1.055	2.87	0.05	20	60.6
Spanish mackerel	*Scomberomorus maculatus*	0.959	2.61	0.07	14	42.4
Flyingfish	Exocoetidae	0.791	2.15	0.04	19	57.6
Blenny	Blenniidae	0.790	2.15	0.05	17	51.5
Sand seatrout	*Cynoscion arenarius*	0.789	2.15	0.05	17	51.5
Herrings	Clupeiformes	0.773	2.10	0.05	17	51.5
Drum	Sciaenidae	0.740	2.01	0.04	18	54.5
Butterfish	*Peprilus paru*	0.711	1.93	0.05	14	42.4
Cusk-eel	Ophidiidae	0.695	1.89	0.04	18	54.5
Scaled sardine	*Harengula jaguana*	0.694	1.89	0.05	14	42.4
Atlantic croaker	*Micropogonias undulatus*	0.658	1.79	0.05	12	36.4
Kingfish	*Menticirrhus*	0.640	1.74	0.05	14	42.4
Puffer	*Sphoeroides*	0.600	1.63	0.06	10	30.3
Fringed flounder	*Etropus crossotus*	0.590	1.60	0.05	13	39.4
Dusky flounder	*Syacium papillosum*	0.555	1.51	0.04	15	45.5
Herrings	Clupeidae	0.534	1.45	0.05	11	33.3
Flounder	*Etropus*	0.525	1.43	0.05	10	30.3
Silver seatrout	*Cynoscion nothus*	0.524	1.42	0.04	12	36.4
Searobin	*Prionotus*	0.467	1.27	0.04	11	33.3
Lizardfish	Synodontidae	0.464	1.26	0.03	14	42.4
Little tunny	*Euthynnus alletteratus*	0.460	1.25	0.04	12	36.4
Left-eye flounder	Bothidae	0.457	1.24	0.04	11	33.3
King mackerel	*Scomberomorus cavalla*	0.448	1.22	0.05	9	27.3
Perciformes	Perciformes	0.446	1.21	0.04	10	30.3
Flounder	*Syacium*	0.442	1.20	0.04	11	33.3
Codlet	*Bregmaceros*	0.430	1.17	0.05	9	27.3
Sand perch	*Diplectrum*	0.392	1.07	0.04	9	27.3
Sea bass	Serranidae	0.350	0.95	0.04	9	27.3
Spanish sardine	*Sardinella aurita*	0.347	0.94	0.05	7	21.2
Flounder	*Citharichthys*	0.341	0.93	0.05	7	21.2
Mackerel	Scombridae	0.329	0.89	0.05	6	18.2
Red drum	*Sciaenops ocellata*	0.319	0.87	0.11	3	9.1

Table 3. (Continued).

Common Name	Scientific Name	Total Larvae/m³	Percent Composition	Mean Larvae/m³	Occurrence in Total Nos. of Samples	Percent Occurrence
Seatrout	*Cynoscion*	0.311	0.85	0.04	7	21.2
Snake eel	Ophichthidae	0.309	0.84	0.03	9	27.3
Pygmy sea bass	*Serraniculus plumilio*	0.305	0.83	0.03	9	27.3
Mojarra	Gerreidae	0.288	0.78	0.04	7	21.2
Bullet mackerel	*Auxis*	0.266	0.72	0.04	7	21.2
Conger eel	Congridae	0.258	0.70	0.04	7	21.2
Spadefish	*Chaetodipterus faber*	0.257	0.70	0.04	7	21.2
Round scad	*Decapterus punctatus*	0.257	0.70	0.04	7	21.2
Barracuda	*Sphyraena*	0.253	0.69	0.03	8	24.2
Butterfish	*Peprilus*	0.248	0.67	0.04	6	18.2
Red snapper	*Lutjanus campechanus*	0.247	0.67	0.03	9	27.3
Worm eel	Microdesmidae	0.242	0.66	0.03	8	24.2
Gulf butterfish	*Peprilus burti*	0.240	0.65	0.04	6	18.2
Scorpionfish	Scorpaenidae	0.236	0.64	0.04	6	18.2
Pipefish	*Syngnathus*	0.234	0.64	0.04	6	18.2
Moray eel	Muraenidae	0.229	0.62	0.04	6	18.2
Blue runner	*Caranx crysos*	0.224	0.61	0.03	7	21.2
Leatherjacket	Balistidae	0.195	0.53	0.04	5	15.2
Bay whiff	*Citharichthys spilopterus*	0.195	0.53	0.04	5	15.2
Wrasse	Labridae	0.192	0.52	0.04	5	15.2
Snapper	*Lutjanus*	0.182	0.50	0.04	5	15.2
Spiny flounder	*Engyophrys senta*	0.177	0.48	0.04	5	15.2
Eel	Anguilliformes	0.170	0.46	0.04	4	12.1
Silversides	Atherinidae	0.165	0.45	0.08	2	6.1
Puffer	Tetraodontidae	0.165	0.45	0.08	2	6.1
Bluefish	*Pomatomus saltatrix*	0.161	0.44	0.05	3	9.1
Vermilion snapper	*Rhomboplites aurorubens*	0.157	0.43	0.04	4	12.1
Flounder	Pleuronectiformes	0.153	0.42	0.03	6	18.2
Jack	Carangidae	0.153	0.42	0.03	6	18.2
Menhaden	*Brevoortia*	0.147	0.40	0.05	3	9.1
Shrimp eel	*Ophichthus gomesi*	0.146	0.40	0.03	5	15.2
Planehead filefish	*Monacanthus hispidus*	0.130	0.35	0.04	3	9.1
Deep-sea angler	Ceratioidei	0.128	0.35	0.04	3	9.1
Spot	*Leiostomus xanthurus*	0.124	0.34	0.04	3	9.1
Banded drum	*Larimus fasciatus*	0.123	0.33	0.04	3	9.1
Atlantic cutlassfish	*Trichiurus lepturus*	0.123	0.33	0.03	4	12.1
Goatfish	Mullidae	0.116	0.32	0.03	4	12.1
Snapper	Lutjanidae	0.115	0.31	0.02	5	15.2
Anchovy	*Anchoa*	0.114	0.31	0.04	3	9.1

Table 3. (Continued).

Common Name	Scientific Name	Total Larvae/m³	Percent Composition	Mean Larvae/m³	Occurrence in Total Nos. of Samples	Percent Occurrence
Star drum	*Stellifer lanceolatus*	0.111	0.30	0.11	1	3.0
Flounder	*Bothus*	0.098	0.27	0.03	3	9.1
Harvestfish	*Peprilus alepidotus*	0.093	0.25	0.05	2	6.1
Dolphin	*Coryphaena hippurus*	0.088	0.24	0.04	2	6.1
Diminutive worm eel	*Pseudomyrophis fugesae*	0.085	0.23	0.03	3	9.1
King snake eel	*Ophichthus rex*	0.077	0.21	0.04	2	6.1
Bigeye scad	*Selar crumenophthalmus*	0.075	0.21	0.03	3	9.1
Blotched snake eel	*Callechelys muraena*	0.075	0.20	0.04	2	6.1
Silver perch	*Bairdiella chrysoura*	0.074	0.20	0.07	1	3.0
Lanternfish	Myctophidae	0.072	0.20	0.04	2	6.1
Mullet	Mugil	0.070	0.19	0.04	2	6.1
Blackfin tuna	*Thunnus atlanticus*	0.070	0.19	0.04	2	6.1
Dragonet	Callionymidae	0.070	0.19	0.02	3	9.1
Filefish	*Monacanthus*	0.069	0.19	0.03	2	6.1
Spadefish	Ephippidae	0.065	0.18	0.06	1	3.0
Sea bass	*Centropristis*	0.061	0.17	0.03	2	6.1
Cobia	*Rachycentrum canadum*	0.061	0.17	0.03	2	6.1
Feather blenny	*Hypsoblennius hentzi*	0.059	0.16	0.03	2	6.1
Spagetti eel	Moringuidae	0.058	0.16	0.03	2	6.1
Lookdown	*Selene vomer*	0.057	0.15	0.03	2	6.1
Scad	*Trachinotus*	0.051	0.14	0.03	2	6.1
Lanternfish	*Diaphus*	0.048	0.13	0.05	1	3.0
Seahorse	*Hippocampus*	0.048	0.13	0.05	1	3.0
Porgy	Sparidae	0.046	0.13	0.02	2	6.1
Chub	Kyphosidae	0.043	0.12	0.04	1	3.0
Snake eel	*Myrichthys*	0.043	0.12	0.04	1	3.0
Filefish	*Aluterus*	0.040	0.11	0.04	1	3.0
Filefish	*Stephanolepis*	0.040	0.11	0.04	1	3.0
Pompano dolphin	*Coryphaena equisetis*	0.037	0.10	0.04	1	3.0
Flounder	*Engyophrys*	0.037	0.10	0.04	1	3.0
Puffer	Tetraodontiformes	0.037	0.10	0.04	1	3.0
Pinfish	*Lagodon rhomboides*	0.036	0.10	0.04	1	3.0
Gulf Stream flounder	*Citharichthys arctifrons*	0.032	0.09	0.03	1	3.0
Weakfish	*Cynoscion regalis*	0.032	0.09	0.03	1	3.0
Trunkfish	*Lactophrys*	0.032	0.09	0.03	1	3.0
Sailfin eel	*Letharchus velifer*	0.032	0.09	0.03	1	3.0
Croaker	*Micropogonias*	0.032	0.09	0.03	1	3.0
Threadfin	Polynemidae	0.032	0.09	0.03	1	3.0
Red hake	*Urophycis chuss*	0.032	0.09	0.03	1	3.0
Frogfish	Antennariidae	0.030	0.08	0.03	1	3.0

Table 3. (Continued).

Common Name	Scientific Name	Total Larvae/m^3	Percent Composition	Mean Larvae/m^3	Occurrence in Total Nos. of Samples	Percent Occurrence
Sooty eel	*Bascanichthys bascanium*	0.030	0.08	0.03	1	3.0
Mackerel	*Scomberomorus*	0.030	0.08	0.03	1	3.0
Lookdown/moonfish	*Selene*	0.030	0.08	0.03	1	3.0
Sargassumfish	*Histrio histrio*	0.030	0.08	0.03	1	3.0
Cardinalfish	Apogonidae	0.028	0.08	0.03	1	3.0
Tripletail	*Lobotes surinamensis*	0.027	0.07	0.03	1	3.0
Pygmy filefish	*Stephanolepis setifer*	0.027	0.07	0.03	1	3.0
Searobin	Triglidae	0.021	0.06	0.02	1	3.0
Needlefish	Belonidae	0.020	0.05	0.02	1	3.0
Short-maned sand eel	*Phaenomonas longissimus*	0.020	0.05	0.02	1	3.0

Table 4. Summary of total catches of larval fishes collected within 25 nmi of West Cameron Block 183 (June 1982 through September 1999).

Station	Latitude	Longitude	Date	Total/m^3	Total/100 m^3
20004	29°30.50'N	93°01.90'W	6/17/1982	1.062	106.173
39315	29°30.05'N	93°00.14'W	6/20/1983	0.431	43.137
40941	29°30.00'N	93°30.00'W	5/11/1984	0.096	9.639
41080	29°30.00'N	93°00.00'W	6/18/1984	0.652	65.217
41111	29°30.00'N	93°30.00'W	6/22/1984	0.524	52.381
41374	29°30.00'N	93°00.30'W	8/12/1984	0.865	86.486
41372	29°30.00'N	93°30.00'W	8/12/1984	0.857	85.714
42849	29°30.00'N	93°01.10'W	6/21/1985	1.226	122.581
44169	29°29.90'N	93°00.00'W	6/21/1986	0.588	58.824
25	29°29.95'N	93°00.02'W	9/17/1986	1.533	153.333
26	29°30.02'N	93°29.93'W	9/17/1986	0.957	95.652
44753	29°34.20'N	93°28.80'W	11/15/1986	0.788	78.788
44755	29°37.00'N	93°05.00'W	11/15/1986	1.600	160.000
45802	29°30.00'N	93°30.00'W	7/4/1987	1.535	153.488
46254	29°30.02'N	93°30.01'W	9/22/1987	0.903	90.323
48959	29°29.10'N	93°29.40'W	11/4/1988	0.833	83.333
50327	29°30.12'N	93°29.81'W	9/17/1989	1.319	131.915
50646	29°29.70'N	93°30.10'W	11/5/1989	0.457	45.714
50648	29°33.20'N	93°00.70'W	11/6/1989	0.327	32.653
36494	29°40.00'N	93°20.00'W	11/17/1989	0.080	8.000
36584	29°40.00'N	93°20.00'W	7/9/1990	0.167	16.667
51939	29°30.10'N	93°30.00'W	9/23/1990	1.579	157.895
36637	29°40.00'N	93°22.00'W	11/7/1990	0.138	13.793
36756	29°40.00'N	93°22.00'W	7/10/1991	1.000	100.000
99	29°20.00'N	93°29.30'W	9/11/1991	1.155	115.493
53534	29°30.10'N	93°00.00'W	11/2/1991	0.489	48.889
36794	29°40.00'N	93°22.00'W	11/5/1991	0.077	7.692
54138	29°24.60'N	93°28.80'W	6/29/1992	0.860	85.981
54185	29°29.80'N	93°00.10'W	7/6/1992	1.889	188.889
41	29°28.00'N	93°30.00'W	9/11/1992	0.921	92.063
55241	29°25.24'N	93°20.23'W	7/7/1993	1.550	155.000
28081	29°30.18'N	93°30.22'W	9/17/1993	1.083	108.333
28088	29°30.20'N	93°00.27'W	9/18/1993	1.226	122.581
186	29°30.11'N	93°00.13'W	7/9/1994	1.652	165.217
183	29°29.46'N	93°29.67'W	7/9/1994	2.667	266.667
28028	29°30.00'N	93°30.00'W	9/16/1994	2.000	200.000
28035	29°30.00'N	93°00.40'W	9/17/1994	0.929	92.857
154	29°26.24'N	93°29.26'W	10/31/1994	1.111	111.111
4150	29°29.96'N	93°00.03'W	7/10/1995	0.773	77.273
28046	29°30.03'N	93°00.11'W	9/13/1995	1.135	113.514
28045	29°29.90'N	93°30.06'W	9/13/1995	0.791	79.070
152	29°30.03'N	93°29.97'W	7/7/1996	1.412	141.176
28032	29°30.06'N	93°00.01'W	9/10/1996	1.417	141.667
28031	29°29.65'N	93°29.79'W	9/10/1996	1.273	127.273
145	29°30.11'N	93°28.96'W	7/5/1997	1.500	150.000
189	29°29.90'N	93°00.08'W	7/9/1997	0.516	51.613
28032	29°30.02'N	93°00.02'W	9/12/1997	1.689	168.889

Table 4. (Continued).

Station	Latitude	Longitude	Date	Total/m^3	Total/100 m^3
28031	29°29.98'N	93°29.95'W	9/12/1997	1.944	194.444
63032	29°33.40'N	93°29.67'W	9/9/1999	0.610	61.017
63040	29°30.01'N	93°00.03'W	9/10/1999	0.907	90.667

Summary Statistics	Total/m^3	Total/100 m^3
Mean	1.022	102.182
Standard Deviation	0.559	55.856
Standard Error	0.079	7.899
95% Confidence Interval	0.159	15.875
99% Confidence Interval	0.212	21.171
Size	50	50
Total	51.091	5109.082
Minimum	0.077	7.692
Maximum	2.667	266.667

Table 5. Taxonomic breakdown of larval fishes collected within 25 nmi of West Cameron Block 183 (June 1982 through July 1999).

Common Name	Scientific Name	Total Larvae/m³	Percent Composition	Mean Larvae/m³	Occurrence in Total Nos. of Samples	Percent Occurrence
Atlantic bumper	*Chloroscombrus chrysurus*	3.844	7.734	0.101	38	76.00
Anchovy	Engraulidae	3.288	6.615	0.087	38	76.00
Atlantic thread herring	*Opisthonema oglinum*	2.824	5.680	0.083	34	68.00
Tonguefish	*Symphurus*	2.762	5.556	0.079	35	70.00
Herring/anchovy	*Clupeiformes*	2.045	4.115	0.079	26	52.00
Sand seatrout	*Cynoscion arenarius*	1.989	4.001	0.071	28	56.00
Unidentified fish	Unidentified fish	1.836	3.694	0.063	29	58.00
Spanish mackerel	*Scomberomorus maculatus*	1.682	3.384	0.070	24	48.00
Kingfish	*Menticirrhus*	1.510	3.038	0.058	26	52.00
Drum	Sciaenidae	1.393	2.802	0.056	25	50.00
Red drum	*Sciaenops ocellata*	1.384	2.784	0.081	17	34.00
Blenny	Blenniidae	1.305	2.624	0.062	21	42.00
Scaled sardine	*Harengula jaguana*	1.255	2.525	0.084	15	30.00
Goby	Gobiidae	1.221	2.457	0.070	16	32.00
Atlantic croaker	*Micropogonias undulatus*	1.206	2.426	0.061	20	40.00
Herring	Clupeidae	1.128	2.269	0.075	16	32.00
Star drum	*Stellifer lanceolatus*	0.697	1.403	0.054	13	26.00
Puffer	*Sphoeroides*	0.694	1.395	0.063	11	22.00
Mojarra	Gerreidae	0.639	1.285	0.049	13	26.00
Spadefish	*Chaetodipterus faber*	0.638	1.283	0.056	11	22.00
Fringed flounder	*Etropus crossotus*	0.636	1.280	0.046	13	26.00
American harvestfish	*Peprilus paru*	0.612	1.232	0.049	13	26.00
Silver seatrout	*Cynoscion nothus*	0.611	1.229	0.053	12	24.00
Flounder	*Etropus*	0.609	1.225	0.056	11	22.00
Flyingfish	Exocoetidae	0.595	1.197	0.061	10	20.00
Spanish sardine	*Sardinella aurita*	0.586	1.178	0.053	11	22.00
Cusk-eel	Ophidiidae	0.564	1.135	0.081	7	14.00
Searobin	*Prionotus*	0.543	1.092	0.060	9	18.00
Silversides	Atherinidae	0.506	1.017	0.057	8	16.00
Pipefish	*Syngnathus*	0.477	0.959	0.056	9	18.00
Seatrout	*Cynoscion*	0.459	0.923	0.054	8	16.00
Perciformes	Perciformes	0.447	0.898	0.060	8	16.00
Butterfish	*Peprilus*	0.433	0.870	0.050	9	18.00
Jack	Carangidae	0.398	0.800	0.043	8	16.00
Left-eye flounder	Bothidae	0.396	0.796	0.040	10	20.00
Dusky flounder	*Syacium papillosum*	0.376	0.757	0.057	7	14.00
King mackerel	*Scomberomorus cavalla*	0.356	0.716	0.047	8	16.00

Table 5. (Continued).

Common Name	Scientific Name	Total Larvae/m^3	Percent Composition	Mean Larvae/m^3	Occurrence in Total Nos. of Samples	Percent Occurrence
Little tunny	*Euthynnus alletteratus*	0.347	0.698	0.059	6	12.00
Spot	*Leiostomus xanthurus*	0.339	0.682	0.057	6	12.00
Menhaden	*Brevoortia*	0.316	0.636	0.079	4	8.00
Mackerel	Scombridae	0.314	0.632	0.063	5	10.00
Leatherjacket	*Oligoplites saurus*	0.272	0.546	0.048	4	8.00
Sole	Soleidae	0.233	0.468	0.045	5	10.00
Bay whiff	*Citharichthys spilopterus*	0.232	0.467	0.054	5	10.00
Codlet	*Bregmaceros*	0.227	0.456	0.058	4	8.00
Flounder	*Syacium*	0.224	0.451	0.046	5	10.00
Searobin	Triglidae	0.221	0.444	0.045	5	10.00
Spadefish	Ephippidae	0.219	0.440	0.055	4	8.00
Flounder	Pleuronectiformes	0.219	0.440	0.055	4	8.00
Flounder	Citharichthys	0.193	0.388	0.055	4	8.00
Halfbeak	Hemiramphidae	0.182	0.366	0.045	4	8.00
Moray eel	Muraenidae	0.166	0.334	0.033	5	10.00
Amberjack	*Seriola*	0.148	0.297	0.074	2	4.00
Snake eel	Ophichthidae	0.141	0.283	0.035	4	8.00
Porgy	Sparidae	0.138	0.278	0.046	3	6.00
Planehead filefish	*Monacanthus hispidus*	0.137	0.276	0.068	2	4.00
Lizardfish	Synodontidae	0.135	0.271	0.034	4	8.00
Gulf butterfish	*Peprilus burti*	0.132	0.266	0.066	2	4.00
Atlantic cutlassfish	*Trichiurus lepturus*	0.128	0.258	0.064	2	4.00
Spotted seatrout	*Cynoscion nebulosus*	0.125	0.252	0.063	2	4.00
Eel	Anguilliformes	0.121	0.244	0.061	2	4.00
Sand perch	*Diplectrum*	0.121	0.243	0.040	3	6.00
Silver perch	*Bairdiella chrysoura*	0.118	0.236	0.059	2	4.00
Pinfish	*Lagodon rhomboides*	0.100	0.201	0.032	2	4.00
Spotted snake eel	*Myrophis punctatus*	0.100	0.201	0.100	1	2.00
Feather blenny	*Hypsoblennius hentzi*	0.091	0.183	0.100	1	2.00
Worm eel	Microdesmidae	0.090	0.181	0.046	2	4.00
Snapper	*Lutjanus*	0.087	0.175	0.030	3	6.00
Lane snapper	*Lutjanus synagris*	0.087	0.175	0.043	1	2.00
Blenny	Blennioidei	0.083	0.168	0.043	2	4.00
Fringed filefish	*Monacanthus ciliatus*	0.083	0.168	0.087	1	2.00
Pompano/permit	*Trachinotus*	0.083	0.168	0.083	1	2.00
Leatherjacket	Balistidae	0.082	0.165	0.083	1	2.00
Sea bass	Serranidae	0.080	0.161	0.083	1	2.00
Wrasse	Labridae	0.074	0.149	0.041	2	4.00
Pygmy sea bass	*Serraniculus plumilio*	0.065	0.131	0.040	2	4.00
Lanternfish	Myctophidae	0.065	0.130	0.037	2	4.00

Table 5. (Continued).

Common Name	Scientific Name	Total Larvae/m^3	Percent Composition	Mean Larvae/m^3	Occurrence in Total Nos. of Samples	Percent Occurrence
Snipe eel	Nettastomodatidae	0.061	0.122	0.033	2	4.00
Sargassumfish	*Histrio histrio*	0.059	0.118	0.019	1	2.00
Pygmy filefish	*Monacanthus setifer*	0.059	0.118	0.061	1	2.00
Bullet mackerel	*Auxis*	0.056	0.112	0.059	1	2.00
Bluefish	*Pomatomus saltatrix*	0.056	0.112	0.059	1	2.00
Tripletail	*Lobotes surinamensis*	0.054	0.110	0.056	1	2.00
Puffer	Tetraodontidae	0.052	0.106	0.056	1	2.00
Scorpionfish	Scorpaenidae	0.051	0.102	0.027	2	4.00
Pipefish	Syngnathidae	0.048	0.096	0.026	2	4.00
Cero mackerel	*Scomberomorus regalis*	0.047	0.094	0.025	2	4.00
Halfbeak	*Hemiramphus*	0.045	0.091	0.048	1	2.00
Harvestfish	*Peprilus alepidotus*	0.045	0.091	0.047	1	2.00
Snapper	Lutjanidae	0.045	0.091	0.045	1	2.00
Round herring	*Etrumeus teres*	0.044	0.089	0.045	1	2.00
Banded drum	*Larimus fasciatus*	0.044	0.089	0.023	2	4.00
Mackerel	*Scomberomorus*	0.044	0.089	0.044	1	2.00
Fourspot flounder	*Paralichthys oblongus*	0.044	0.089	0.044	1	2.00
Mullet	*Mugil*	0.043	0.087	0.044	1	2.00
Weakfish	*Cynoscion regalis*	0.043	0.087	0.044	1	2.00
Round scad	*Decapterus punctatus*	0.043	0.087	0.044	1	2.00
Sharksucker	Echeneidae	0.032	0.065	0.043	1	2.00
Cardinalfish	Apogonidae	0.028	0.057	0.022	2	4.00
Spiny flounder	*Engyophrys senta*	0.028	0.057	0.037	1	2.00
Short-maned sand eel	*Phaenomonas longissimus*	0.028	0.056	0.032	1	2.00
Sculpin	Cottidae	0.025	0.050	0.028	1	2.00
Blenny	*Hypsoblennius*	0.025	0.050	0.028	1	2.00
Bigscale	Melamphaidae	0.025	0.050	0.028	1	2.00
Lookdown/moonfish	*Selene*	0.025	0.050	0.025	1	2.00
Moonfish	*Selene setapinnis*	0.025	0.050	0.025	1	2.00
Blackcheek tonguefish	*Symphurus plagiusa*	0.025	0.050	0.025	1	2.00
Driftfish	Stromateidae	0.020	0.039	0.025	1	2.00
Blue runner	*Caranx crysos*	0.019	0.038	0.025	1	2.00
Bristlemouth	*Cyclothone*	0.006	0.012	0.025	1	2.00
Lanternfish	*Diaphus*	0.006	0.012	0.020	1	2.00
Lanternfish	*Diogenichthys atlanticus*	0.006	0.012	0.006	1	2.00
Lanternfish	*Diplospinus multistriatus*	0.006	0.012	0.006	1	2.00

Table 5. (Continued).

Common Name	Scientific Name	Total Larvae/m^3	Percent Composition	Mean Larvae/m^3	Occurrence in Total Nos. of Samples	Percent Occurrence
Bristlemouth	Gonostomatidae	0.006	0.012	0.006	1	2.00
Temperate bass	*Howella*	0.006	0.012	0.006	1	2.00
Lanternfish	*Hygophum*	0.006	0.012	0.006	1	2.00
Lanternfish	*Lampanyctus*	0.006	0.012	0.006	1	2.00
Lightfish	*Maurolicus muelleri*	0.006	0.012	0.006	1	2.00
Lanternfish	*Myctophum*	0.006	0.012	0.006	1	2.00
Barracudina	Paralepididae	0.006	0.012	0.006	1	2.00
Lightfish	*Vinciguerria attenuata*	0.006	0.012	0.006	1	2.00
Oceanic lightfish	*Vinciguerria nimbaria*	0.006	0.012	0.006	1	2.00

Table 6. Summary of total larval fishes collected within the 30 nmi SEAMAP sampling grid containing both West Cameron Block 213 and West Cameron Block 183 (June 1984 through July 1999).

Station	Latitude	Longitude	Date	Total/m³	Total/100 m³
20004	29°30.50'N	93°01.90'W	6/17/1982	1.273	127.273
39315	29°30.05'N	93°00.14'W	6/20/1983	0.929	92.857
40941	29°30.00'N	93°30.00'W	5/11/1984	0.679	67.857
41079	29°00.00'N	93°00.00'W	6/18/1984	0.431	43.137
41080	29°30.00'N	93°00.00'W	6/18/1984	1.889	188.889
41108	29°00.01'N	93°31.53'W	6/22/1984	0.622	62.222
41111	29°30.00'N	93°30.00'W	6/22/1984	1.550	155.000
41242	29°06.00'N	93°00.00'W	7/13/1984	1.471	147.059
41376	29°00.00'N	93°00.00'W	8/12/1984	0.096	9.639
41375	29°15.10'N	93°00.00'W	8/12/1984	1.319	131.915
41374	29°30.00'N	93°00.30'W	8/12/1984	0.921	92.063
41372	29°30.00'N	93°30.00'W	8/12/1984	1.083	108.333
41386	29°00.00'N	93°30.00'W	8/13/1984	0.857	85.714
41387	29°15.00'N	93°30.00'W	8/13/1984	0.679	67.857
42849	29°30.00'N	93°01.10'W	6/21/1985	0.674	67.416
42855	29°00.00'N	93°00.10'W	6/22/1985	1.211	121.053
44169	29°29.90'N	93°00.00'W	6/21/1986	1.135	113.462
44176	29°00.10'N	93°00.00'W	6/22/1986	1.223	122.581
27	29°00.80'N	93°30.02'W	9/17/1986	0.808	80.769
25	29°29.95'N	93°00.02'W	9/17/1986	0.657	65.672
26	29°30.02'N	93°29.93'W	9/17/1986	2.667	266.667
44753	29°34.20'N	93°28.80'W	11/15/1986	1.520	152.000
44755	29°37.00'N	93°05.00'W	11/15/1986	0.516	51.613
45789	29°00.20'N	93°29.90'W	7/3/1987	1.533	153.333
45802	29°30.00'N	93°30.00'W	7/4/1987	2.000	200.000
46253	29°00.98'N	93°30.02'W	9/22/1987	0.833	83.333
46254	29°30.02'N	93°30.01'W	9/22/1987	1.652	165.217
48530	29°00.00'N	93°28.90'W	9/21/1988	0.645	64.516
48959	29°29.10'N	93°29.40'W	11/4/1988	1.579	157.895
48975	29°06.10'N	93°04.00'W	11/5/1988	0.907	90.667
50327	29°30.12'N	93°29.81'W	9/17/1989	1.304	130.434
50646	29°29.70'N	93°30.10'W	11/5/1989	1.097	109.677
50655	29°00.09'N	93°29.70'W	11/6/1989	1.027	102.703
50648	29°33.20'N	93°00.70'W	11/6/1989	1.417	141.667
36494	29°40.00'N	93°20.00'W	11/17/1989	1.944	194.444
36584	29°40.00'N	93°20.00'W	7/9/1990	1.689	168.889
51929	29°00.00'N	93°00.00'W	9/23/1990	0.757	75.676
51939	29°30.10'N	93°30.00'W	9/23/1990	0.773	77.273
36637	29°40.00'N	93°22.00'W	11/7/1990	0.636	63.637
53240	29°00.00'N	93°00.00'W	7/4/1991	0.652	65.217
53239	29°00.60'N	93°29.80'W	7/4/1991	0.857	85.714
36756	29°40.00'N	93°22.00'W	7/10/1991	0.926	92.593

Table 6. (Continued).

Station	Latitude	Longitude	Date	Total/m^3	Total/100 m^3
93	29°00.10'N	93°00.10'W	9/10/1991	0.465	46.512
99	29°20.00'N	93°29.30'W	9/11/1991	0.327	32.653
53534	29°30.10'N	93°00.00'W	11/2/1991	1.111	111.111
53538	29°00.00'N	93°00.10'W	11/3/1991	0.524	52.381
36794	29°40.00'N	93°22.00'W	11/5/1991	0.610	61.017
54138	29°24.60'N	93°28.80'W	6/29/1992	1.064	106.452
54185	29°29.80'N	93°00.10'W	7/6/1992	1.000	100.000
54182	29°04.77'N	93°00.27'W	7/6/1992	1.032	103.158
43	29°00.00'N	93°00.00'W	9/11/1992	1.062	106.173
42	29°00.00'N	93°30.10'W	9/11/1992	0.865	86.486
41	29°28.00'N	93°30.00'W	9/11/1992	0.873	87.273
54530	29°00.03'N	93°00.04'W	11/6/1992	1.333	133.333
55233	29°03.42'N	93°33.04'W	7/6/1993	0.403	40.268
55241	29°25.24'N	93°20.23'W	7/7/1993	0.080	8.000
28082	29°00.45'N	93°31.47'W	9/17/1993	1.524	152.381
28081	29°30.18'N	93°30.22'W	9/17/1993	1.617	161.702
28088	29°30.20'N	93°00.27'W	9/18/1993	1.412	141.176
55236	29°00.41'N	93°21.81'W	10/31/1993	1.600	160.000
183	29°29.46'N	93°29.67'W	7/9/1994	0.138	13.793
186	29°30.11'N	93°00.13'W	7/9/1994	0.791	79.070
28029	29°00.20'N	93°30.00'W	9/16/1994	0.957	95.652
28028	29°30.00'N	93°30.00'W	9/16/1994	0.582	58.228
28035	29°30.00'N	93°00.40'W	9/17/1994	0.733	73.267
151	29°00.27'N	93°30.05'W	10/30/1994	1.333	133.333
154	29°26.24'N	93°29.26'W	10/31/1994	0.167	16.667
4150	29°29.96'N	93°00.03'W	7/10/1995	0.077	7.692
28045	29°29.90'N	93°30.06'W	9/13/1995	0.489	48.889
28046	29°30.03'N	93°00.11'W	9/13/1995	2.000	200.000
28051	29°00.05'N	93°29.93'W	9/14/1995	1.303	130.303
145	29°00.13'N	93°29.38'W	7/6/1996	0.588	58.824
152	29°30.03'N	93°29.97'W	7/7/1996	1.855	185.454
28031	29°29.65'N	93°29.79'W	9/10/1996	1.178	117.808
28032	29°30.06'N	93°00.01'W	9/10/1996	1.087	108.696
145	29°30.11'N	93°28.96'W	7/5/1997	1.135	113.514
187	29°00.62'N	93°30.60'W	7/9/1997	0.903	90.323
189	29°29.90'N	93°00.08'W	7/9/1997	1.155	115.493
28030	29°02.00'N	93°29.23'W	9/11/1997	0.457	45.714
28033	29°00.32'N	93°00.15'W	9/12/1997	0.788	78.788
28031	29°29.98'N	93°29.95'W	9/12/1997	0.860	85.981
28032	29°30.02'N	93°00.02'W	9/12/1997	1.257	125.714
183	29°00.51'N	93°30.43'W	7/11/1999	1.535	153.488
63033	29°00.13'N	93°31.85'W	9/9/1999	2.000	200.000
63032	29°33.40'N	93°29.67'W	9/9/1999	1.500	150.000
63040	29°30.01'N	93°00.03'W	9/10/1999	1.226	122.581

Table 6. (Continued).

Summary Statistics	Total m^3	Total $100m^3$
Mean	1.040	103.992
Standard Deviation	0.503	50.293
Standard Error	0.054	5.423
95% Confidence Interval	0.108	10.783
99% Confidence Interval	0.143	14.291
Size	86	86
Total	89.433	8943.281
Minimum	0.077	7.692
Maximum	2.667	266.667

month, larval fish concentrations can be assumed to be lower. Again, the data upon which our impacts estimates are developed must be considered worst case;

3) NOAA has provided an estimate of 11,587 fish eggs per million gallons of water based on SEAMAP data (Alex Chester memorandum to Roy Crabtree, Regional Administrator July 11, 2003). However, although eggs are collected and sorted from the samples, they are not cataloged into the SEAMAP system. SEAMAP has thousands of eggs, but they do not have any way to access or provide station specific data (Kim Williams, NOAA SEAMAP archive St. Petersburg, Florida, personal communication). We have utilized the NOAA estimate of 11,587 fish eggs per million gallons of water in **Table 1** of this response. The SEAMAP data are collected in the spring and fall when spawning and recruitment of fish species may be seasonally high. NOAA goes on to state in the same memorandum quoted above, "One believes that the impacts would vary seasonally depending upon what species are present. Currently the number of sampling sites and information available from the SEAMAP data are too general to be useful." and
4) For the purposes of the Gulf Landing LNG terminal ichthyoplankton impacts assessment, we have assumed 100% mortality in all organisms entrained. It is possible that mortality rates may actually be substantially lower that 100% when this system becomes operational. Again, the impacts assessment presented in our ER and this supplementary response is considered to be a worst case estimate.

3.0 IMPACTS ON DESIGN AND APPLICATION

Given the preceding further assessment, we believe that the project impacts on the environment are not appreciable, and that our engineering assessments and conclusions remain valid as presented in the application. Specifically, we would not change the choice of vaporizer technology or the measures that we have selected to minimize the impact of these vaporizers on the marine environment. The following paragraphs describe the basis for this conclusion.

3.1 VAPORIZER SELECTION

The Gulf Landing project has used Shell's Sustainable Development Principles for the review and selection of alternatives throughout the project. This process has been described in Section 1.4 and Section 2.0 of the ER. In particular, we have spent a considerable amount of effort on the assessment and evaluation of our impacts on the environment associated with selection of the vaporization technology. Gulf Landing proposes to use Open Rack Vaporizers (ORVs), this technology is considered to be the most appropriate technology for the project as addressed in Section 2.3 of the ER.

However, this vaporizer technology uses ambient temperature seawater for a heating medium. Seawater is pumped from the sea, treated to minimize biofouling, passed over the vaporizers, and then returned to the sea.

3.2 SYSTEMS TO MINIMIZE IMPACT

It should be noted that the predicted impacts on ichthyoplankton are considered to be the unmitigated worse case impacts. The project has proposed several design and operational measures to minimize our impacts through the selection of appropriate mitigation and protection measures.

The overall suite of design features to minimize impact on marine life is discussed in Sections 2.5 and 2.6 and Appendix B of the ER. Summaries of the design features selected are as follows:

- The trend of the marine life data shows that there is less marine life at lower depths in the water column. Gulf Landing proposed to locate its seawater intake as low as reasonably practical to minimize the potential for marine life entrainment.
- Intakes will be designed such that they are aligned horizontally to minimize the potential for coning effects, which induce water flows from the surface.
- Reducing the volume of water needed by selecting a relatively high and acceptable delta T of 10°C, which is less than the seasonal temperature fluctuations.
- Intake screening technology has been selected based on a reasonably practical approach, whereby 0.25-inch intake screens have been selected as the most appropriate proven technology available.
- Intake velocities at the intakes will be managed below 0.5 ft/s to ensure that mobile species are able to swim away from the intakes.
- Further, we are committed to monitor our impact on marine life as described in Appendix B. (If it is determined that the project has a significant adverse impact on marine life, we can investigate the use of alternative technologies to exclude marine life from the water intake system, or other appropriate measures to minimize the impacts.)

We believe that the engineering design features and proposed monitoring program represent a proactive and complete approach to minimizing impact to the environment. The choice of marine life data does not impact the design or proposed operation.

4.0 SUMMARY

Gulf Landing has reviewed the SEAMAP database for ichthyoplankton and fish egg data in the Gulf of Mexico West Cameron 213 and 183 areas. Use of this alternative data set does not result in a significantly different interpretation of the impact estimate for marine life from the proposed project than was predicted and quantified within our application.

It should be noted that the SEAMAP database does not present depth stratified ichthyoplankton or fish egg data at our proposed locations.

It is not currently feasible to estimate a more accurate mortality rate for ichthyoplankton associated with the Proposed Action, as:

- There are limited data that estimate the mortality rate for impinged or entrained ichthyoplankton in the heating water system for the LNG vaporizers. We have conservatively assumed 100% mortality for all impinged or entrained ichthyoplankton.
- Ichthyoplankton stratification data within the water column are not available. We have conservatively assumed that the same concentration of ichthyoplankton would be at the intake location as at the surface.
- The impacts associated with the physical presence of the GBS cannot be quantitatively estimated. We have assumed that the impact of the Gulf Landing terminal would be similar to other offshore installations. As such, we believe that the Shaw et al. (2002) data set is more representative than the SEAMAP data set because it was developed for use in evaluated offshore oil and gas activities.

For completeness, we have reiterated our proposed course of action for minimizing and monitoring impacts on the environment.

We do not propose any design or operational changes based on the reassessment of impacts developed from the SEAMAP database.

5.0 LITERATURE CITED

SEAMAP. Plankton data retrieved December 2003 from SEAMAP FTP site: ftp.mslabs.noaa.gov/pub/seamap/gulf/plankton.zip

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Wolff, G.A. and J.H. Wormuth. 1984. Chapter 8 Zooplankton. In: R.W. Hann., C.P. Giamonna, and R.E. Randall (eds.), Offshore Oceanographic and Environmental Monitoring Services for the Strategic Petroleum Reserve: Eighteen-month report for the West Hackberry Site from May 1982 through November 1983. U.S. Department of Energy. NTIS, Springfield, VA. DOE-PO10850-3.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center. 2003. Memorandum dated July 11, 2003 from Alex Chester for Nancy B. Thompson, Science Administrator to Roy Crabtree, Regional Administrator regarding review of Chevron's Draft EIA for the Port Pelican Deepwater Liquefied Natural Gas (LNG) Port.