APPENDIX B

HABITAT EVALUATION PROCEDURE (HEP) EVALUATION

APPENDIX B
HEP Evaluation

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INTRODUCTION

The purpose of this analysis was to quantify the environmental effects to fish and wildlife resources via the Packery Channel Alternative described in Section 2.0. As with for the Packery Channel PSP (USACE, 1999, discussed in Section 1.0 of the Draft EIS), the evaluation of aquatic organism effects was performed by conducting Habitat Evaluation Procedures (HEP) analysis for select aquatic species.

METHODS

The species for the present analysis were selected to be consistent with USACE (1999). For the PSP, a detailed review of the TPWD fisheries data was conducted along with meetings with key personnel from the resource agencies and academia. The main criteria for selection were having a fully developed Habitat Suitability Index (HSI) model and model parameters that were consistent with the study area. Five species, including *Penaeus aztecus* (brown shrimp), *Cynoscion nebulosus* (spotted seatrout), *Scianops ocellatus* (red drum), *Paralichthys lethostigma* (southern flounder), and *Paralichthys albigutta* (Gulf flounder) were selected for HEP analysis.

The FWS documentation for the HSI models for these five species are as follows:

TITLE	REFERENCE	DATE
Northern Gulf of Mexico Brown and White Shrimp	FWS/OBS-82/10.54	September 1983
Spotted Seatrout	FWS/OBS-82/10.75	September 1984
Larval and Juvenile Red Drum	FWS/OBS-82/10.74	September 1984
Southern and Gulf Flounder	Biological Report 82 (10.92)	June 1985

The essential components of each of the above models are water quality, food and cover. Table B-1 provides a description of the model parameters for each species. Although these species were agreed upon for the PSP, some limitations to the HSI models are present. The most notable limitation is that open bay bottom habitat is not considered in the HSI model for brown shrimp. Therefore, the Corpus Christi Bay area was not evaluated using the brown shrimp HSI model. A second limitation for the brown shrimp model is that the optimal HSI value listed for salinity is between 10–-20 ppt which is considerably lower than existing conditions in the study area. However, the main reason to include brown shrimp is to provide a comparison to the earlier work conducted by Nueces County, by the FWS, and the PSP. Additionally, all water quality measurements associated with the HSI model for both the southern and Gulf flounder should be taken from within 15 inches of the bottom. The TPWD Resource Monitoring Data for water quality profiles were reviewed and it was determined that only slight differences occurred between the surface and bottom. Therefore, all salinity values were utilized for HSI analysis. The small vertical differences in water quality in the project area are most likely due to the shallow depth of the project area.

WATER QUALITY

The water quality parameters needed for HSI analysis include salinity, temperature and dissolved oxygen (DO). The baseline salinity conditions were established using the data set (1958-1993) that Ward and Armstrong (1997) compiled for the CCBNEP program (CCBNEP-13), supplemented with the 1994-1997 TPWD Resource Monitoring Program data.

The five species selected require calculation of five different salinity regimes for HSI determination. These regimes are as follows for the respective species:

SALINITY (PPT)	SPECIES
Mean salinity throughout the year	Southern and Gulf Flounder
Minimum monthly mean salinity during winter and spring (December - May)	Spotted Seatrout
Maximum monthly mean salinity over the year	Spotted Seatrout
Mean salinity during the spring (January - May)	Brown Shrimp
Mean salinity during period of larval development (September - November)	Red Drum

To evaluate the effects of the Packery Channel inlet on salinity, two salinity values were calculated, one that represents a long-term average (Average Annual), and another to represent a short-term, high salinity event (80th percentile). The long-term average salinity period was determined by using average conditions from the historical database (1958-1997). The 80th percentile value is that for which 80% of the values fall below this concentration; it would theoretically be expected to occur once every 5 years. The same historical period of record was used to calculate the 80th percentile values for each of the five salinity regimes defined above.

As described in Section 4.2.2, the baseline condition for this analysis included any change resulting from modifications to the JFK Causeway. However, the slight changes in salinity expected from modifications to the Causeway were not sufficient to alter HSI values calculated from the historical baseline conditions used for the PSP. Therefore, the historical baseline conditions used for the PSP were used for the present HEP analyses. For both periods, TxBLEND model runs were conducted for the Packery Channel inlet (Section 4.2.1) and the differences with the base (no inlet) condition quantified. The salinity changes were presented as contour intervals. The new salinity values, adjusted to reflect these changes over the project area were used in the HSI models. To do this, the project area was divided into 2-minute latitude sections from Aransas Pass (27°50') to the mouth of Baffin Bay (27°20') using Nautical Chart 11308. Therefore, Corpus Christi Bay was divided into four 2-minute latitude sections (50'-48', 48'-46', 46'-44', and 44'-42') and the Upper Laguna Madre was divided into eleven 2-minute latitude sections (42'-40',40'-38',..., 22'-20'). This enabled the averaging of baseline salinity values for each section. A figure with the contours of salinity change was then laid over the project area figures and average differences per section were recorded. The average difference per section was then subtracted/added from/to the baseline salinity section value. This process of obtaining areal coverage of before and after salinity values is a necessary step for HSI model application.

The temperature and DO baseline information was determined from the 1978-1997 TPWD Resource Monitoring Program data. Unlike salinity, temperature and DO were held constant, because major changes in temperature and DO are not anticipated as a result of the project. Holding these parameters constant provided a means of evaluating effects based solely on changes in salinity.

FOOD AND COVER

Food and cover parameters are also required for an estimation of HSI. For this project, these include emergent wetlands, submerged aquatic vegetation, and substrate composition. The percentage of emergent wetlands was set constant at 5% for both Corpus Christi Bay and the Upper Laguna Madre. The percentage of submerged aquatic vegetation was set at 10% for Corpus Christi Bay and 70% for the Upper Laguna Madre (USACE, 1999). A precise estimate of the percentage of vegetation is not necessary for comparison between alternatives; however, an estimate is necessary to evaluate whether water quality (i.e., salinity) or food and cover is the limiting factor. The substrate composition classification, derived from the actual model development data used for the southern and Gulf flounder model, was set at 34-66% mud or silt with the remainder sand or shell. This substrate classification was utilized across the entire study area. As with temperature and DO, emergent and submerged aquatic vegetation and substrate classification were held constant for the baseline and Packery Channel alternative.

AREA

With the changes in salinity quantified and all other parameters remaining constant, HSI values were calculated for each species for the Packery Channel alternative. However, in order to compute the actual habitat units (HU) for a project, the impacted area must be quantified. The HSI value multiplied by the Area is the final HEP product reported as Average Annual Habitat Units (AAHU). Water surface area and shoreline length calculations were based on the use of the Nueces and Kleberg counties, Bentley Microstation design files created by the Texas Department of Transportation (TxDOT). A 2-minute latitude grid was created using Bentley's GeoCoordinator beginning at 27° 20' north and ending at 27° 52' north. This grid was then used in Bentley's Geographics to clean and build water surface polygons and segment shorelines. The resulting polygons and segmented shorelines were imported into ESRI's ArcView 3.0a in which the water surface areas were calculated.

RESULTS AND DISCUSSIONS

HEP ANALYSIS

As noted above, the HEP analysis requires two main components; HSI values and area of impact. To calculate the HSI values, species-specific parameters are needed for both baseline (without-project) and with-project alternatives. As previously discussed, five species were selected for HEP analysis. The species-specific parameters for these species are described in Table B-1. The calculation of baseline conditions for these parameters was discussed above. The baseline conditions for these parameters are important since the HSI models only consider the lowest HSI value between the water quality and food/cover components of the model. Therefore, if the food/cover component is not sufficient to support a species and results in a low HSI value, changes in salinity are of no consequence. This is exactly the case for red drum in which the food/cover component drives the model because of the limited amount of emergent vegetation. Therefore, the baseline condition and Packery Channel alternative for red drum will produce the same number of habitat units regardless of changes in salinity. For that reason, red drum will not be discussed further. Alternatively, when a parameter falls within the optimal range for both the baseline and Packery Channel alternative, the HSI value is 1 in all instances and no further examination of that parameter is needed. This is the case for both water temperature and DO, as well as minimum monthly mean salinity during the winter and spring for spotted seatrout; therefore all of these parameters were removed from the evaluation.

The remaining parameters include three salinity scenarios (mean salinity throughout the year, maximum monthly mean salinity over the year, and mean salinity during the spring), submerged aquatic vegetation, and substrate composition. The baseline salinity conditions for the three scenarios are presented in Table B-2 with respect to the 2-minute latitude sections and both time periods (Average Annual and 80th percentile). Figure B-1 graphically depicts the conditions. A salinity gradient across the Upper Laguna Madre is evident with fairly similar conditions in Corpus Christi Bay for all scenarios and time periods. The approximate yearly mean for average-annual conditions at the mouth of the Packery Channel alternative is 31 ppt. The Gulf salinity used for the TxBLEND model remained constant at 34 ppt. In fact, considering the historical database for the entire study area used for this project from the mouth of Baffin Bay to Aransas Pass (1958-1997), the Gulf salinity is only exceeded 29% of the time (21% in Corpus Christi Bay and 49% in the Upper Laguna Madre). The 80th percentile values are obviously higher for all three scenarios but exhibit a similar gradient in Corpus Christi Bay and the Upper Laguna Madre (Figure B-1).

The salinity changes predicted by the TxBLEND model for the Packery Channel alternative are presented in Table B-3. A negative value in Table B-3 represents an average salinity decrease while a positive value represents an average salinity increase for each segment. Table B-3 demonstrates that salinity increases are predicted in the study area using the yearly and spring means for average annual conditions. Salinity reductions are predicted for the Packery Channel alternative using the maximum means for average annual conditions and all 80th percentile conditions.

The HSI values (baseline and Packery Channel) for brown shrimp, spotted seatrout, southern flounder and Gulf flounder are presented in Table B-4. Red drum HSI values were not included due to the food/cover limitation, noted above. Also, as previously discussed, no HSI values were calculated in Corpus Christi Bay for brown shrimp due to the model limitation concerning open bay bottom habitat. The HSI values for spotted seatrout in Corpus Christi Bay are limited by the food/cover parameter (10% SAV) and thus comparisons for spotted seatrout in Corpus Christi Bay with respect to salinity changes are also not possible. The HSI calculation for both southern and Gulf flounders involves the addition of the water quality and food/cover component as opposed to the selection for the lowest value (i.e., either water quality or food and cover) as used for the other species' HSI models. Therefore, salinity changes in Corpus Christi Bay can be assessed with respect to expected impact on habitat for southern and Gulf flounders. The acreage for each 2-minute latitude segment is also presented in Table B-4.

As noted above, Average Annual Habitat Units (AAHU) are calculated by multiplying the HSI value by the acreage. The acreage of the impacted area for the Packery Channel alternative was calculated and multiplied by both the baseline HSI value and the Packery Channel HSI value. The AAHUs for the baseline and Packery Channel alternative are presented in Table B-5. The final product for this HEP analysis is a comparison of the baseline AAHU verses the Packery Channel alternative AAHU to determine the net change. The net changes are presented in Table B-6 and summarized below.

NET CHANGES IN AVERAGE ANNUAL HABITAT UNITS

	Annual Average Conditions	80th Percentile
Gulf Flounder	-132	246
Southern Flounder	-371	218
Spotted Seatrout	368	6040
Brown Shrimp	-7	464

For average annual conditions, Gulf and southern flounder and brown shrimp all showed slight negative changes in AAHU. This is because of the increase in salinity that was predicted for the yearly and spring mean scenarios under average annual conditions. The increasing salinities lowered the HSI values for these species and ultimately lowered the AAHU. The spotted seatrout was the only species that showed habitat gains under average annual conditions. The reason for the habitat gains is that salinity reductions were predicted using the maximum monthly mean scenario for average annual conditions.

All species demonstrated habitat gains with respect to the 80th percentile conditions. As previously mentioned, the 80th percentile scenario is reflective of what would theoretically occur once every five years. The increased habitat for the spotted seatrout reflects the steep linear function present in the HSI model, where reductions in salinity from 45 ppt to 37.5 ppt make large differences in HSI values (0 to 1, respectively).

An examination was conducted to better describe what the number of AAHU's gained or lost means with respect to the entire study area. For this assessment, only the average annual conditions were considered. The 80th percentile values provide a glimpse at "worst case" conditions but can not be scaled back to represent average conditions. Furthermore, the average annual conditions for the HEP analysis takes into account "best" and "worst" case conditions. Therefore, all further discussion of environmental benefits will focus on average annual conditions with respect to the HEP analysis. The table below presents the net change in AAHU, reported as a percentage of available AAHU for the study area.

NET PERCENTILE CHANGE IN AAHU

	Annual Average Conditions
Gulf Flounder	-0.11%
Southern Flounder	-0.34%
Spotted Seatrout	0.60%
Brown Shrimp	-0.02%

For example, the net change in AAHU for spotted seatrout under average annual conditions was 368 AAHU (Table B-6). The net change (368) divided by the available AAHU for the Study Area (61,717 AAHU, which equals the sum of baseline AAHU for the same conditions from Table B-5) results in a 0.60% value. Brown shrimp, and southern and Gulf flounder all show very slight negative percentages of overall habitat loss. The spotted seatrout shows a minuscule positive gain (0.6%) in habitat for the Packery Channel alternative.

SUMMARY

The HEP analyses conducted for the Packery Channel alternative supports the earlier studies conducted by FWS, Nueces County, and for the PSP by showing that habitat units for modeled species would be gained under periods of high salinity. Of the five species selected for HSI evaluation, the red drum was eliminated, *a priori*, because of food and cover limitations. Under average annual conditions, all species, except for spotted seatrout, lost habitat. This reflected the lower yearly and spring mean salinity scenarios. Only the spotted seatrout, which utilized the maximum monthly mean salinity scenario, showed slight increases in habitat units with the opening of a channel to the Gulf. Therefore, based on the HEP analysis focusing on changes in salinity, the conclusion is that under average annual conditions very little environmental effect (positive or negative) would result from the Packery Channel alternative.

The increase in shoreline acreage and ease of migration issues were not quantified in this evaluation. For the PSP, it was determined by the resource agencies that a quantification of fish and wildlife resources impacts due to changes in tidal amplitude was not feasible. The literature and experts interviewed seem to agree that an opening to the Gulf would aid the ingress and egress of aquatic organisms. An opening would also provide an escape route during extreme weather conditions.

FIGURE B-1
Baseline Salinity Conditions

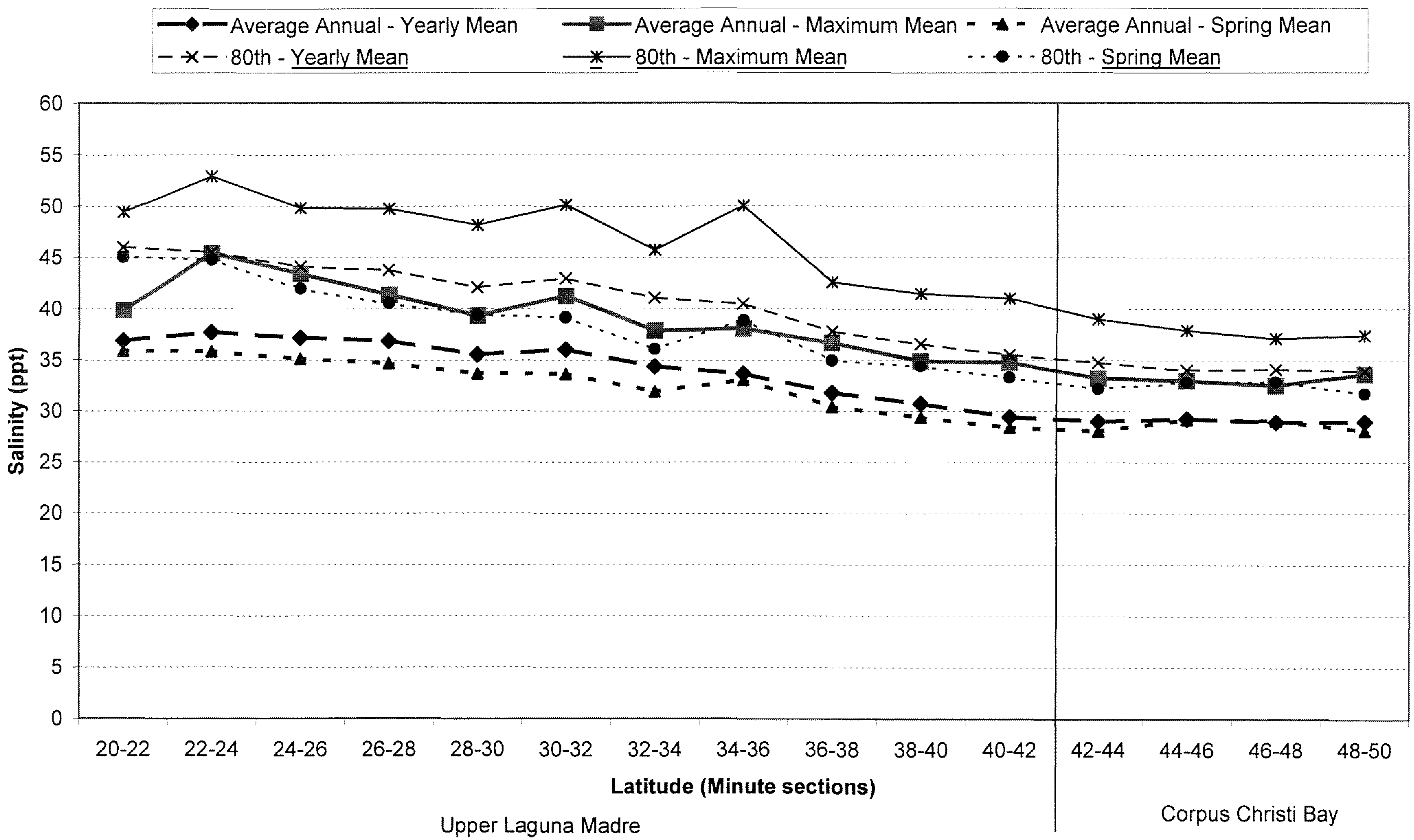

TABLE B-1

HEP Species - Model Criteria

SPECIES	MODELS	CRITERIA	DESCRIPTION
Brown shrimp (postlarval and juvenile)		Water Quality	Mean salinity during spring Mean water temperature during spring
		Food & Cover	Percentage of estuary covered by vegetation (marsh and seagrass) Substrate composition
Spotted seatrout		Water Quality	Lowest monthly mean winter and spring salinity Highest monthly mean summer salinity Lowest monthly mean winter water temperature Highest monthly mean summer water temperature
		Food & Cover	Percentage of study area with submerged and emergent vegetation, submerged islands, shell reefs, and oyster beds
Red drum (larval and juvenile)	Vegetated	Water Quality	Average water temperature during larval development Average salinity during larval development
		Food & Cover	Percentage of intertidal wetlands Percentage of submerged vegetation
	Non-vegetated	Water Quality	Average water temperature during larval development Average salinity during larval development
		Food & Cover	Percentage of intertidal wetlands Substrate composition Mean depth
Southern flounder		Water Quality	Average annual salinity 10 to 15 cm above the bottom Average temperature 10 to 15 cm above the bottom, May to August Average minimum dissolved oxygen concentration 10 to 15 cm above the bottom, May to August
		Cover	Substrate composition
Gulf flounder		Water Quality	Average annual salinity 10 to 15 cm above the bottom Average temperature 10 to 15 cm above the bottom, May to August Average minimum dissolved oxygen concentration 10 to 15 cm above the bottom, May to August
		Cover	Substrate composition

TABLE B-2

Baseline Salinity Conditions over Project Area

	SALINITY (ppt)					
Latitude	Average Annual Conditions			80th Percentile		
(Minutes)	Yearly Mean[1]	Maximum Mean[2]	Spring Mean[3]	Yearly Mean[1]	Maximum Mean[2]	Spring Mean[3]
20-22	36.92	39.82	35.90	46.04	49.40	45.06
22-24	37.71	45.41	35.84	45.50	52.90	44.78
24-26	37.21	43.38	35.14	44.08	49.82	41.96
26-28	36.90	41.32	34.70	43.80	49.70	40.50
28-30	35.55	39.31	33.67	42.08	48.16	39.40
30-32	36.04	41.21	33.65	43.00	50.10	39.16
32-34	34.40	37.83	31.93	41.10	45.70	36.10
34-36	33.66	38.08	33.05	40.50	50.04	38.90
36-38	31.83	36.66	30.45	37.80	42.60	35.00
38-40	30.74	34.88	29.39	36.60	41.44	34.40
40-42	29.45	34.75	28.39	35.50	41.00	33.30
42-44	29.01	33.26	28.02	34.76	39.00	32.20
44-46	29.24	32.94	29.21	34.00	37.86	32.80
46-48	28.94	32.48	29.08	34.10	37.08	32.82
48-50	28.96	33.60	28.04	33.90	37.40	31.70

[1] Mean salinity for the year using the 1958-1997 database.

[2] Maximum monthly mean salinity for the year using the 1958-1997 database.

[3] Mean spring salinity (January to May) for the year using the 1958-1997 database.

TABLE B-3

Predicted Salinity Changes

AVERAGE ANNUAL CONDITIONS				80th PERCENTILE			
Latitude (minute range)	BASELINE SALINITY (ppt)	BASELINE AREA (acres)	PACKERY CHANNEL Salinity Change (ppt)	Latitude (minute range)	BASELINE SALINITY (ppt)	BASELINE AREA (acres)	PACKERY CHANNEL Salinity Change (ppt)
YEARLY MEAN				**YEARLY MEAN**			
50-52	28.96	10642	0.00	50-52	33.90	10642	0.00
48-50	28.96	22633	0.00	48-50	33.90	22633	0.00
46-48	28.94	23818	0.25	46-48	34.10	23818	0.00
44-46	29.24	19557	0.50	44-46	34.00	19557	0.00
42-44	29.01	14235	0.50	42-44	34.76	14235	0.00
40-42	29.45	7219	0.75	40-42	35.50	7219	-0.50
38-40	30.74	7453	1.50	38-40	36.60	7453	-1.25
36-38	31.83	5074	1.25	36-38	37.80	5074	-1.00
34-36	33.66	5072	1.00	34-36	40.50	5072	-1.00
32-34	34.40	5742	1.00	32-34	41.10	5742	-0.50
30-32	36.04	5075	1.00	30-32	43.00	5075	-0.50
28-30	35.55	4251	0.50	28-30	42.08	4251	0.00
26-28	36.90	3712	0.50	26-28	43.80	3712	0.00
24-26	37.21	3387	0.00	24-26	44.08	3387	0.00
22-24	37.71	2961	0.00	22-24	45.50	2961	0.00
20-22	36.92	2395	0.00	20-22	46.04	2395	0.00
MAXIMUM MEAN				**MAXIMUM MEAN**			
50-52	33.60	10642	0.00	50-52	37.40	10642	-0.50
48-50	33.60	22633	0.00	48-50	37.40	22633	-0.50
46-48	32.48	23818	0.00	46-48	37.08	23818	-0.50
44-46	32.94	19557	0.00	44-46	37.86	19557	-0.75
42-44	33.26	14235	0.00	42-44	39.00	14235	-1.00
40-42	34.75	7219	-0.50	40-42	41.00	7219	-1.25
38-40	34.88	7453	-1.25	38-40	41.44	7453	-2.75
36-38	36.66	5074	-1.00	36-38	42.60	5074	-2.25
34-36	38.08	5072	-1.00	34-36	50.04	5072	-2.25
32-34	37.83	5742	-0.50	32-34	45.70	5742	-2.00
30-32	41.21	5075	-0.50	30-32	50.10	5075	-1.50
28-30	39.31	4251	0.00	28-30	48.16	4251	-1.25
26-28	41.32	3712	0.00	26-28	49.70	3712	-0.50
24-26	43.38	3387	0.00	24-26	49.82	3387	-0.25
22-24	45.41	2961	0.00	22-24	52.90	2961	0.00
20-22	39.82	2395	0.00	20-22	49.40	2395	0.00
SPRING MEAN				**SPRING MEAN**			
50-52	28.04	10642	0.00	50-52	31.70	10642	0.00
48-50	28.04	22633	0.00	48-50	31.70	22633	0.00
46-48	29.08	23818	0.25	46-48	32.82	23818	0.00
44-46	29.21	19557	0.50	44-46	32.80	19557	0.00
42-44	28.02	14235	0.50	42-44	32.20	14235	0.00
40-42	28.39	7219	0.75	40-42	33.30	7219	-0.50
38-40	29.39	7453	1.50	38-40	34.40	7453	-1.25
36-38	30.45	5074	1.25	36-38	35.00	5074	-1.00
34-36	33.05	5072	1.00	34-36	38.90	5072	-1.00
32-34	31.93	5742	1.00	32-34	36.10	5742	-0.50
30-32	33.65	5075	1.00	30-32	39.16	5075	-0.50
28-30	33.67	4251	0.50	28-30	39.40	4251	0.00
26-28	34.70	3712	0.50	26-28	40.50	3712	0.00
24-26	35.14	3387	0.00	24-26	41.96	3387	0.00
22-24	35.84	2961	0.00	22-24	44.78	2961	0.00
20-22	35.90	2395	0.00	20-22	45.06	2395	0.00

TABLE B-4

HSI Values

AVERAGE ANNUAL CONDITIONS				80th PERCENTILE			
Latitude (minute range)	BASELINE HSI	AREA (acres)	Packery Channel HSI value	Latitude (minute range)	BASELINE HSI	AREA (acres)	Packery Channel HSI value
YEARLY MEAN - GULF FLOUNDER				YEARLY MEAN - GULF FLOUNDER			
50-52	0.837	10642	0.837	50-52	0.837	10642	0.837
48-50	0.837	22633	0.837	48-50	0.837	22633	0.837
46-48	0.837	23818	0.837	46-48	0.837	23818	0.837
44-46	0.837	19557	0.837	44-46	0.837	19557	0.837
42-44	0.837	14235	0.837	42-44	0.837	14235	0.837
40-42	0.837	7219	0.837	40-42	0.832	7219	0.837
38-40	0.837	7453	0.837	38-40	0.824	7453	0.832
36-38	0.837	5074	0.837	36-38	0.810	5074	0.819
34-36	0.837	5072	0.832	34-36	0.786	5072	0.796
32-34	0.837	5742	0.832	32-34	0.781	5742	0.786
30-32	0.828	5075	0.819	30-32	0.760	5075	0.765
28-30	0.832	4251	0.828	28-30	0.771	4251	0.771
26-28	0.819	3712	0.815	26-28	0.748	3712	0.748
24-26	0.819	3387	0.819	24-26	0.748	3387	0.748
22-24	0.815	2961	0.815	22-24	0.730	2961	0.730
20-22	0.819	2395	0.819	20-22	0.724	2395	0.724
YEARLY MEAN - SOUTHERN FLOUNDER				YEARLY MEAN - SOUTHERN FLOUNDER			
50-52	0.785	10642	0.785	50-52	0.751	10642	0.751
48-50	0.785	22633	0.785	48-50	0.751	22633	0.751
46-48	0.785	23818	0.785	46-48	0.751	23818	0.751
44-46	0.785	19557	0.782	44-46	0.751	19557	0.751
42-44	0.785	14235	0.782	42-44	0.744	14235	0.744
40-42	0.782	7219	0.779	40-42	0.740	7219	0.744
38-40	0.775	7453	0.765	38-40	0.732	7453	0.740
36-38	0.765	5074	0.758	36-38	0.721	5074	0.729
34-36	0.755	5072	0.748	34-36	0.699	5072	0.708
32-34	0.748	5742	0.744	32-34	0.695	5742	0.699
30-32	0.736	5075	0.729	30-32	0.676	5075	0.680
28-30	0.740	4251	0.736	28-30	0.685	4251	0.685
26-28	0.729	3712	0.729	26-28	0.665	3712	0.665
24-26	0.729	3387	0.721	24-26	0.665	3387	0.665
22-24	0.725	2961	0.725	22-24	0.649	2961	0.649
20-22	0.729	2395	0.729	20-22	0.644	2395	0.644
MAXIMUM MEAN - SPOTTED SEATROUT				MAXIMUM MEAN - SPOTTED SEATROUT			
50-52	0.200	10642	0.200	50-52	0.200	10642	0.200
48-50	0.200	22633	0.200	48-50	0.200	22633	0.200
46-48	0.200	23818	0.200	46-48	0.200	23818	0.200
44-46	0.200	19557	0.200	44-46	0.200	19557	0.200
42-44	0.200	14235	0.200	42-44	0.200	14235	0.200
40-42	1.000	7219	1.000	40-42	0.730	7219	0.816
38-40	1.000	7453	1.000	38-40	0.683	7453	0.931
36-38	1.000	5074	1.000	36-38	0.577	5074	0.775
34-36	0.966	5072	1.000	34-36	0.000	5072	0.000
32-34	0.966	5742	1.000	32-34	0.000	5742	0.447
30-32	0.730	5075	0.730	30-32	0.000	5075	0.000
28-30	0.856	4251	0.856	28-30	0.000	4251	0.000
26-28	0.683	3712	0.683	26-28	0.000	3712	0.000
24-26	0.447	3387	0.447	24-26	0.000	3387	0.000
22-24	0.000	2961	0.000	22-24	0.000	2961	0.000
20-22	0.816	2395	0.816	20-22	0.000	2395	0.000
SPRING MEAN - BROWN SHRIMP				SPRING MEAN - BROWN SHRIMP			
50-52	NA	10642	NA	50-52	NA	10642	NA
48-50	NA	22633	NA	48-50	NA	22633	NA
46-48	NA	23818	NA	46-48	NA	23818	NA
44-46	NA	19557	NA	44-46	NA	19557	NA
42-44	NA	14235	NA	42-44	NA	14235	NA
40-42	0.732	7219	0.732	40-42	0.732	7219	0.732
38-40	0.732	7453	0.732	38-40	0.732	7453	0.732
36-38	0.732	5074	0.732	36-38	0.730	5074	0.732
34-36	0.732	5072	0.732	34-36	0.566	5072	0.611
32-34	0.732	5742	0.732	32-34	0.693	5742	0.712
30-32	0.732	5075	0.732	30-32	0.566	5075	0.589
28-30	0.732	4251	0.732	28-30	0.542	4251	0.542
26-28	0.732	3712	0.730	26-28	0.490	3712	0.490
24-26	0.730	3387	0.730	24-26	0.400	3387	0.400
22-24	0.693	2961	0.693	22-24	0.000	2961	0.000
20-22	0.693	2395	0.693	20-22	0.000	2395	0.000

TABLE B-5

Average Annual Habitat Units (AAHU)

AVERAGE ANNUAL CONDITIONS					80th PERCENTILE				
	BASELINE			Packery Channel		BASELINE			Packery Channel
Latitude (minute range)	HSI	AREA (acres)	AAHU	AAHU	Latitude (minute range)	HSI	AREA (acres)	AAHU	AAHU
YEARLY MEAN - GULF FLOUNDER					**YEARLY MEAN - GULF FLOUNDER**				
50-52	0.837	10642	8907	8907	50-52	0.837	10642	8907	8907
48-50	0.837	22633	18944	18944	48-50	0.837	22633	18944	18944
46-48	0.837	23818	19935	19935	46-48	0.837	23818	19935	19935
44-46	0.837	19557	16369	16369	44-46	0.837	19557	16369	16369
42-44	0.837	14235	11915	11915	42-44	0.837	14235	11915	11915
40-42	0.837	7219	6042	6042	40-42	0.832	7219	6006	6042
38-40	0.837	7453	6238	6238	38-40	0.824	7453	6141	6201
36-38	0.837	5074	4247	4247	36-38	0.810	5074	4110	4155
34-36	0.837	5072	4245	4220	34-36	0.786	5072	3987	4037
32-34	0.837	5742	4806	4777	32-34	0.781	5742	4484	4513
30-32	0.828	5075	4202	4157	30-32	0.760	5075	3857	3883
28-30	0.832	4251	3537	3520	28-30	0.771	4251	3278	3278
26-28	0.819	3712	3040	3025	26-28	0.748	3712	2777	2777
24-26	0.819	3387	2774	2774	24-26	0.748	3387	2534	2534
22-24	0.815	2961	2413	2413	22-24	0.730	2961	2162	2162
20-22	0.819	2395	1961	1961	20-22	0.724	2395	1734	1734
YEARLY MEAN - SOUTHERN FLOUNDER					**YEARLY MEAN - SOUTHERN FLOUNDER**				
50-52	0.785	10642	8354	8354	50-52	0.751	10642	7992	7992
48-50	0.785	22633	17767	17767	48-50	0.751	22633	16998	16998
46-48	0.785	23818	18697	18697	46-48	0.751	23818	17887	17887
44-46	0.785	19557	15352	15293	44-46	0.751	19557	14687	14687
42-44	0.785	14235	11175	11132	42-44	0.744	14235	10591	10591
40-42	0.782	7219	5645	5624	40-42	0.740	7219	5342	5371
38-40	0.775	7453	5776	5702	38-40	0.732	7453	5456	5515
36-38	0.765	5074	3881	3846	36-38	0.721	5074	3658	3699
34-36	0.755	5072	3829	3794	34-36	0.699	5072	3545	3591
32-34	0.748	5742	4295	4272	32-34	0.695	5742	3991	4014
30-32	0.736	5075	3735	3700	30-32	0.676	5075	3431	3451
28-30	0.740	4251	3146	3129	28-30	0.685	4251	2912	2912
26-28	0.729	3712	2706	2706	26-28	0.665	3712	2469	2469
24-26	0.729	3387	2469	2442	24-26	0.665	3387	2253	2253
22-24	0.725	2961	2147	2147	22-24	0.649	2961	1922	1922
20-22	0.729	2395	1746	1746	20-22	0.644	2395	1542	1542
MAXIMUM MEAN - SPOTTED SEATROUT					**MAXIMUM MEAN - SPOTTED SEATROUT**				
50-52	0.200	10642	2128	2128	50-52	0.200	10642	2128	2128
48-50	0.200	22633	4527	4527	48-50	0.200	22633	4527	4527
46-48	0.200	23818	4764	4764	46-48	0.200	23818	4764	4764
44-46	0.200	19557	3911	3911	44-46	0.200	19557	3911	3911
42-44	0.200	14235	2847	2847	42-44	0.200	14235	2847	2847
40-42	1.000	7219	7219	7219	40-42	0.730	7219	5270	5891
38-40	1.000	7453	7453	7453	38-40	0.683	7453	5090	6939
36-38	1.000	5074	5074	5074	36-38	0.577	5074	2928	3932
34-36	0.966	5072	4900	5072	34-36	0.000	5072	0	0
32-34	0.966	5742	5547	5742	32-34	0.000	5742	0	2567
30-32	0.730	5075	3705	3705	30-32	0.000	5075	0	0
28-30	0.856	4251	3639	3639	28-30	0.000	4251	0	0
26-28	0.683	3712	2535	2535	26-28	0.000	3712	0	0
24-26	0.447	3387	1514	1514	24-26	0.000	3387	0	0
22-24	0.000	2961	0	0	22-24	0.000	2961	0	0
20-22	0.816	2395	1954	1954	20-22	0.000	2395	0	0
SPRING MEAN - BROWN SHRIMP					**SPRING MEAN - BROWN SHRIMP**				
50-52	NA	10642	NA	NA	50-52	NA	10642	NA	NA
48-50	NA	22633	NA	NA	48-50	NA	22633	NA	NA
46-48	NA	23818	NA	NA	46-48	NA	23818	NA	NA
44-46	NA	19557	NA	NA	44-46	NA	19557	NA	NA
42-44	NA	14235	NA	NA	42-44	NA	14235	NA	NA
40-42	0.732	7219	5284	5284	40-42	0.732	7219	5284	5284
38-40	0.732	7453	5456	5456	38-40	0.732	7453	5456	5456
36-38	0.732	5074	3714	3714	36-38	0.730	5074	3704	3714
34-36	0.732	5072	3713	3713	34-36	0.566	5072	2871	3099
32-34	0.732	5742	4203	4203	32-34	0.693	5742	3979	4088
30-32	0.732	5075	3715	3715	30-32	0.566	5075	2873	2989
28-30	0.732	4251	3112	3112	28-30	0.542	4251	2304	2304
26-28	0.732	3712	2717	2710	26-28	0.490	3712	1819	1819
24-26	0.730	3387	2473	2473	24-26	0.400	3387	1355	1355
22-24	0.693	2961	2052	2052	22-24	0.000	2961	0	0
20-22	0.693	2395	1659	1659	20-22	0.000	2395	0	0

TABLE B-6

Net Changes in Average Annual Habitat Units (AAHU)

	AVERAGE ANNUAL CONDITIONS	80th PERCENTILE	AVERAGE ANNUAL CONDITIONS
Latitude (minute range)	Packery Channel Net Changes (AAHU)	Packery Channel Net Changes (AAHU)	Packery Channel Net Changes (% AAHU)
	YEARLY MEAN - GULF FLOUNDER	YEARLY MEAN - GULF FLOUNDER	YEARLY MEAN - GULF FLOUNDER
50-52	0	0	0.00%
48-50	0	0	0.00%
46-48	0	0	0.00%
44-46	0	0	0.00%
42-44	0	0	0.00%
40-42	0	36	0.00%
38-40	0	60	0.00%
36-38	0	46	0.00%
34-36	-25	51	-0.60%
32-34	-29	29	-0.60%
30-32	-46	25	-1.09%
28-30	-17	0	-0.48%
26-28	-15	0	-0.49%
24-26	0	0	0.00%
22-24	0	0	0.00%
20-22	0	0	0.00%
TOTAL	**-132**	**246**	**-0.11%**
	YEARLY MEAN - SOUTHERN FLOUNDER	YEARLY MEAN - SOUTHERN FLOUNDER	YEARLY MEAN - SOUTHERN FLOUNDER
50-52	0	0	0.00%
48-50	0	0	0.00%
46-48	-59	0	-0.31%
44-46	-43	0	-0.28%
42-44	-22	29	-0.19%
40-42	-75	60	-1.32%
38-40	-36	41	-0.61%
36-38	-36	46	-0.91%
34-36	-23	23	-0.60%
32-34	-36	20	-0.83%
30-32	-17	0	-0.46%
28-30	0	0	0.00%
26-28	-27	0	-1.00%
24-26	0	0	0.00%
22-24	0	0	0.00%
20-22	0	0	0.00%
TOTAL	**-371**	**218**	**-0.34%**
	MAXIMUM MEAN - SPOTTED SEATROUT	MAXIMUM MEAN - SPOTTED SEATROUT	MAXIMUM MEAN - SPOTTED SEATROUT
50-52	0	0	0.00%
48-50	0	0	0.00%
46-48	0	0	0.00%
44-46	0	621	0.00%
42-44	0	1848	0.00%
40-42	0	1005	0.00%
38-40	172	0	2.31%
36-38	195	2567	3.85%
34-36	0	0	0.00%
32-34	0	0	0.00%
30-32	0	0	0.00%
28-30	0	0	0.00%
26-28	0	0	0.00%
24-26	0	0	0.00%
22-24	0	0	0.00%
20-22	0	0	0.00%
TOTAL	**368**	**6040**	**0.60%**
	SPRING MEAN - BROWN SHRIMP	SPRING MEAN - BROWN SHRIMP	SPRING MEAN - BROWN SHRIMP
50-52	N/A	N/A	NA
48-50	N/A	N/A	NA
46-48	0	0	NA
44-46	0	0	NA
42-44	0	10	NA
40-42	0	228	0.00%
38-40	0	109	0.00%
36-38	0	117	0.00%
34-36	0	0	0.00%
32-34	-7	0	-0.18%
30-32	0	0	0.00%
28-30	0	0	0.00%
26-28	0	0	0.00%
24-26	0	0	0.00%
22-24	0	0	0.00%
20-22	0	0	0.00%
TOTAL	**-7**	**464**	**-0.02%**