Population Studies of Fin-fish on Artificial Shell Reefs In Corpus Christi Bay and the Upper Laguna Madre

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Abstract: Four artificial reefs and four control stations were sampled each month with a modified otter trawl. Breakwater Reef, in Corpus Christi Bay, yielded more organisms than any other location sampled. Breakwater Reef Control Station was the second most productive area. Oso Reef Control Station yielded more than Oso Reef Station. Catches from the Laguna Madre were always small but the reefs were always more productive than the controls. Brown shrimp, Penaeus aztecus; white shrimp, P. setiferus; bay anchovey, Anchoa mitchilli; and atlantic croaker, Micropogon undulatus, were the four most abundant species taken. Habitat appears to have been improved in the Laguna Madre but not in Corpus Christi Bay.

Introduction: The Parks and Wildlife Department has made several attempts to improve habitat in areas ordinarily unsuitable for sport or commercial finfish. Most of these attempts have dealt with the construction of artificial reefs in the Gulf of Mexico or in the bays.

Artificial reefs were constructed in Corpus Christi Bay and the Upper Laguna Madre to study the effects of such measures on the fin-fish habitat within the bays (Breuer, 1962). Breakwater, Oso and College Reefs were built in Corpus Christi Bay while Green Hill and Oil Channel Reefs were built in the Upper Laguna Madre. Bradley (1964) reported that College Reef had sanded over and it was abandoned.

A nine inch layer of washed mudshell had been placed on the bay floor in the construction of each reef. The reefs were all approximately square, with those in the Laguna Madre covering almost one acre and those in Corpus Christi Bay almost one-half acre.

Oso and College Reefs were placed on a hard, sandy bottom while Breakwater Reef was put on a bottom of soft mud and sand. All three reefs were in water six to eight feet deep.

Green Hill and Oil Channel Reefs were placed on similar bottoms of sand and shell. The water depth over each was three to five feet.

All control stations had substrates similar to those of the near by reefs.

After the abandonment of College Reef, various methods of determining the degree of success of the remaining reefs were employed. Fish traps were set on and off the reefs, hook and line sampling was tried on a regular basis and an attempt was made to keep up with the catch of fishermen who frequented the reefs. None of these methods was particularly successful in determining if the habitat had actually been improved.

In 1965, a new sampling program was established to try and determine the relative abundance of species similar in feeding habits, useful as food, or otherwise associated with game fish on the reef and off the reef.

Materials and Methods: Control areas with substrates similar to those on which the reefs were placed were set up within one-half mile of each reef. Once a month, a modified 10-foot trawl was pulled on each reef for a period of five minutes. A five minute sample was also taken at each control site.

The trawl was of 1 1/2 -inch stretch mesh and had a strip of canvas sewn around the lead line to prevent snagging.

All samples in each bay were taken on the same day.

Results: Table 1 lists the number of species taken from each reef and control site for the year. Although the total number of specimens was greater from the control stations than from the reefs, there was actually only one station at which the control yielded more organisms than the reef. This was the Oso Reef control station where over 400 per cent more organisms were caught than on the reef.

In the other areas, reefs were consistently more productive than control areas. Breakwater Reef was more productive by 19 per cent, Green Hill by 82 per cent and Oil Channel by 179 per cent.

The commercial shrimp, Penaeus aztecus and P. setiferus; anchovy, Anchoa mitchilli; atlantic croaker, Micropogon undulatus; pinfish, Lagodon rhomboides; spot croaker, Leiostomus xanthurus;and blue crab, Callinectes sapidus,were the most abundant species taken.

The Commercial shrimp seemed always to be more abundant at the control areas, as did anchovies and atlantic croakers. Pinfish; pigfish, Orthopristes chrysopterus; and blue crabs were taken most consistently on the reefs. Many of the species listed in Table 1 were not taken in sufficient numbers to allow evaluation of environmental preferences.

P. aztecus, the predominant commercial shrimp taken, was most abundant during April, May and June. The atlantic croaker was most plentiful in April and May, as was the blue crab. Anchovies became numerous during summer months. Other species taken were found randomly throughout the year.

Discussion: Breakwater Reef was the most productive station in the variety and number of species taken, but it had a smaller percentage of increase in catch over the corresponding control station than either Green Hill or Oil Channel Reefs. Breakwater Control Station was much more productive than Oso Control Station, which was the only area yielding better results than the adjacent reef.

These results tend to corroborate conclusions in the 1964 report that Breakwater Reef was placed in an area already suitable for a wide variety of organisms due to its position near the Corpus Christi Ship Channel and an adjacent breakwater. Since the area was an established habitit for various and numerous species, any improvement attributed to the addition of an artificial reef would be questionable.

Oso Reef was the least productive of all reefs sampled, while its control station production was second only to that of the Breakwater control and was much greater than that of either reef or control site in the Laguna Madre.

In the 1964 report, it was speculated the Oso Reef provided some habitat-improvement to the southwest portion of Corpus Christi Bay. This speculation was not borne out in 1965, since the samples from the control site contained more specimens than those from the reef in almost every instance. This strongly indicates that the artificial reef in that part of the bay failed to provide any significant habitat improvement.

Neither the Laguna Madre reefs nor the control stations were as productive as the stations in Corpus Christi Bay. However, Green Hill and Oso Channel Reefs consistently produced more fauna than their corresponding control stations, indicating that the habitat was improved by the artificial reefs. Much more work on the problem is needed before any long term evaluation can be made. Reefs of different shapes and heights should be constructed in selected locations to test for better designs, and studies should be made in probable areas prior to construction of the reefs to more accurately determine the effects of these reefs.

It is now apparent that placement of a man-made protrustion on the bay floor does not necessarily provide significant improvement to the fin-fish habitat. As previously stated, much study should be done before the construction of reefs, to determine not only the areas in which habitat improvement would be desirable, but also the areas in which artificial reefs would be the most practicable means of achieving the desired results.

In the case of Oil Channel and Green Hill Reefs, the general habitat seems to be improved with regard to the presence of varieties of small invertebrates and fish, while Oso and Breakwater Reefs seem to provide little or no improvement.

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Table 1
Total 1965 Catch at Artificial Reef Stations and at Control Stations

Species	Station	No. (mode)	Control-No. (mode)
Penaeus aztecus	Breakwater	227(35-85mm)	305(50-95mm)
	Oso	0	10(55-95)
	Green Hill	1(34mm)	0
	Oil Channel	4(45-60mm)	3(29-37mm)
P. setiferus	Breakwater	32(60-100,130-350mm)	47(70-100,120-160mm)
	Oso	0	12(100-145mm)
	Green Hill	0	0
	Oil Channel	0	0
P. duorarum	Breakwater	8(90-105mm)	7(65-105mm)
	Oso	0	4(42-72mm)
	Green Hill	1(38mm)	2(41,75mm)
	Oil Channel	1(51mm)	5(40-41,71-75mm)
Anchoa mitchilli	Breakwater	60(30-33,57-60mm)	42(40-53mm)
	Oso	16(40-43mm)	280(35-45mm)
	Green Hill	24(45-55mm)	20(31-51mm)
	Oil Channel	0	4(45mm)
Micropogon undulatus	Breakwater	188(50-90mm)	79(45-90mm)
	Oso	16(75-90,165-175mm)	54(55-75,105-115mm)
	Green Hill	0	6(33-68,200-205mm)
	Oil Channel	1(32mm)	5(42-60mm)
Lagodon rhomboides	Breakwater	4(115-160mm)	1(115mm)
	Oso	16(100-130mm)	0
	Green Hill	67(50-105mm)	31(55-95mm)
	Oil Channel	65(60-90mm)	7(90-110mm)
Leiostomus xanthurus	Breakwater	13(65-85mm)	7(65-85mm)
	Oso	4(75-90mm)	8(125-175mm)
	Green Hill	6(65-90mm)	0
	Oil Channel	10(70-100,110-160mm)	8(52-64,100-150mm)
Callinectes sapidus	Breakwater	36(35-60,150-160mm)	10(70-90mm)
	Oso	3(144-156mm)	4(55-85mm)
	Green Hill	0	0
	Oil Channel	0	0
C. danae	Breakwater	2(38,50mm)	3(36-78mm)
	Oso	0	4(27-56mm)
	Green Hill	0	0
	Oil Channel	0	0

Table 1--continued

Species	Station	No.(mode)	Control-No.(mode)
Orthopristes chrysopterus	Breakwater	4(105-130mm)	0
	Oso	3(90-180mm)	0
	Green Hill	7(130-160mm)	1(80mm)
	Oil Channel	10(60-70,110-210mm)	0
Bairdella chrysura	Breakwater	3(55-100mm)	2(115,130mm)
	Oso	10(165-175mm)	0
	Green Hill	3(75-90mm)	0
	Oil Channel	0	0
Symphurus plagiusa	Breakwater	7(40-70,100-105mm)	18(35-55mm)
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Spheroides nephelus	Breakwater	14(40-85mm)	2(60,98mm)
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Bagre marinus	Breakwater	7(65-75mm)	3(70-85mm)
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Galeichthys felis	Breakwater	4(90-115mm)	1(140mm)
	Oso	1(115mm)	1(140mm)
	Green Hill	0	0
	Oil Channel	0	0
Cynoscion arenarius	Breakwater	2(39,70mm)	3(84-125mm)
	Oso	0	2(185,210mm)
	Green Hill	0	0
	Oil Channel	0	0
G. nothus	Breakwater	1(168mm)	0
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Syacium gunteri	Breakwater	2(65,67mm)	4(68-95mm)
	Oso	0	1(120mm)
	Green Hill	0	0
	Oil Channel	0	0
Archosargus probatocephalus	Breakwater	1(177mm)	0
	Oso	1(204mm)	1(365mm)
	Green Hill	1(340mm)	0
	Oil Channel	1(300mm)	1(320mm)

Table 1--continued

Species	Station	No. (mode)	Control-No. (mode)
Achirus fasciatus	Breakwater	5(40-50mm)	0
	Oso	0	1(45mm)
	Green Hill	0	0
	Oil Channel	0	0
Squilla empusa	Breakwater	4(65-95mm)	2(36,42mm)
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Synodus foetens	Breakwater	1(145mm)	0
	Oso	1(280mm)	1(200mm)
	Green Hill	0	0
	Oil Channel	0	0
Porichthys porosissimus	Breakwater	1(130mm)	2(40,127mm)
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Loligo pealei	Breakwater	2(68,130mm)	1(53mm)
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Loliguncula brevis	Breakwater	1(43mm)	0
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Chilomycterus schoepfii	Breakwater	0	0
	Oso	3(190-200mm)	0
	Green Hill	0	0
	Oil Channel	0	0
Menticirrhus littoralis	Breakwater	2(75,120mm)	0
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Caranx hippos	Breakwater	2(70,90mm)	0
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0

Table 1--continued

Species	Station	No. (mode)	Control-No. (mode)
Paralichthys lethostigma	Breakwater	0	0
	Oso	0	0
	Green Hill	1(240mm)	1(260mm)
	Oil Channel	0	0
Ancylopsetta quadrocellata	Breakwater	1(121mm)	0
	Oso	0	1(180mm)
	Green Hill	0	0
	Oil Channel	0	0
Prionotus martis	Breakwater	1(170mm)	0
	Oso	1(180mm)	0
	Green Hill	0	0
	Oil Channel	0	0
Urophysis floridanus	Breakwater	2(105,110mm)	0
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Chaetodipterus faber	Breakwater	0	0
	Oso	1(170mm)	0
	Green Hill	0	0
	Oil Channel	0	0
Stellifer lanceolatus	Breakwater	1(35mm)	0
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Opsanus tau	Breakwater	1(145mm)	0
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Mugil cephalus	Breakwater	1(145mm)	0
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Trachypenaeus similis	Breakwater	1(54mm)	1(87mm)
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0

Table 1--continued

Species	Station	No.(mode)	Control-No.(mode)
Gobiesox strumosus	Breakwater	1(167mm)	0
	Oso	0	0
	Green Hill	0	0
	Oil Channel	0	0
Reef Totals (Specimens)	Breakwater	642	540
	Oso	76	384
	Green Hill	111	61
	Oil Channel	92	33
Total No. Specimens		921	1,018