

**STUDY TITLE:** Long-Term Monitoring at the East and West Flower Garden Banks

**REPORT TITLE:** Long-Term Monitoring at the East and West Flower Garden Banks

**CONTRACT NUMBER:** 14-35-0001-30662

**SPONSORING OCS REGION:** Gulf of Mexico

**APPLICABLE PLANNING AREAS:** Western and Central Gulf of Mexico

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**COSTS:** FY 1994: \$69,497; FY 1995: \$67,640

**CUMULATIVE PROJECT COST:** \$137,137

**PROGRAM MANAGER:** David A. Gettleson

**AFFILIATION:** Continental Shelf Associates, Inc.

**ADDRESS:** 759 Parkway Street, Jupiter, Florida 33477

**PRINCIPAL INVESTIGATOR\*:** Stephen T. Viada

**KEY WORDS:** Northwestern Gulf of Mexico; Flower Garden Banks; corals; community structure; population levels; accretionary growth; encrusting growth; bleaching; temperature

**BACKGROUND:** The East and West Flower Garden Banks are located on the outer continental shelf of the Gulf of Mexico, approximately 204 km (110 nmi) southeast of Galveston, Texas. They are topographic prominences of bedrock which have been uplifted by the upward intrusion of under lying salt deposits or diapirs. The bedrock has been capped with a layer of hard bottom, formed from the skeletons of corals and other calcareous organisms, and biogenic calcareous sands and gravels. Thriving coral reefs comprised of 18 species of hermatypic (reef-building) scleractinian corals occur on the banks in a geographic area which is considered area which is considered to be near the their northern physiological limits. Environmental threats to the Flower Garden Banks, including extensive development of petroleum hydrocarbon resources and other human activities on and in the U.S. Department of the Interior, Minerals Management Service (MMS) and the NOAA National marine Sanctuary Program to cooperatively sponsor a long-term monitoring program on the banks which addresses concerns regarding both chronic and acute impacts. The Flower Garden Banks were designated as a National Marine Sanctuary in January 1992.

**OBJECTIVES:** (1) To provide relevant and timely environmental data to agencies which develop policies concerning oil and gas exploration and development in the vicinity of biologically sensitive habitats; (2) To document acute and long-term changes in reef-building and other associated communities within the high-diversity *Diploria-Montastrea-Porites* Zone at the Flower Garden Banks which may be attributed to impacts of oil and gas exploration and development or other human activities; (3) To document natural variation in reef-building and associated communities within this biotic zone on the banks; and (4) To duplicate methodologies and, whenever possible, to utilize study stations developed during the previous long-term monitoring study in an effort to maintain a continuous database of information on the banks.

**DESCRIPTION:** The scope of the present monitoring contract specified analyses of field data collected during 1992 (which had not been analyzed) and the collection of field data and associated analyses during 1994 and 1995. Field efforts in 1994 and 1995 were conducted within the previously established 100 m by 100 m study site on each bank. The following tasks were performed at each study site: 14 stratified random photographic transects were photographed and analyzed for the determination of population levels of corals and other associated reef biota; 20 permanent growth spike stations were measured for the estimation of accretionary growth of the coral *Montastrea annularis*; two coral cores were collected from separate colonies of *M. annularis* and analyzed for the determination of accretionary growth rates by measurement of annular corallum density bands (sclerochronology); 60 permanent stations were photographed and analyzed for the estimation of encrusting growth of the coral *Diploria strigosa*; 40 permanent 8 m<sup>2</sup> quadrat stations were photographed and analyzed for counts of coral growth, retreat, disease, and mortality, and estimates of percent coral cover and coral bleaching; two diver-held, repetitive video transects were recorded and analyzed for the qualitative assessment and documentation of reef health; two recording thermographs were retrieved and serviced; one recording light meter was deployed and serviced; daily measurements were made of water temperature, salinity, dissolved oxygen, and ambient light from near surface and near bottom depths; and six sediment samples were collected and archived.

**SIGNIFICANT CONCLUSIONS:** Estimates of total coral cover, cover and relative dominance of individual coral species, and species diversity within the East and West Flower Garden Banks study sites are comparable with previous studies conducted within the same study sites. Specific differences in the estimates between studies are not considered to represent trends or deterioration of habitat quality. Estimates of the growth rates of *M. Annularis* and *D. strigosa* made at both study sites indicate favorable conditions for both accretionary and encrusting growth during the 1994-1995 field surveys. Accretionary and encrusting growth estimates made from re-established as necessary to maximize accuracy of growth rate estimates. Coral bleaching was observed on 8 m<sup>2</sup> photographic quadrats collected during 1992, 1994, and 1995. The extent of bleaching observed on the two study sites was most pronounced during 1995.

**STUDY RESULTS:** Means total coral cover on the East and West Flower Garden Banks study sites was 48.2% and 44.1%, respectively. Total coral cover was higher in

both 1995 and 1994 than in 1992, and higher on the East Flower Garden Bank study site than the West Flower Garden Bank study site. *M. annularis* was the dominant reef component on the East and West Flower Garden Banks study sites, followed by *D. strigosa*. Cover of *M. annularis* and *Siderastrea siderea* was significantly higher in 1995 transects than in both 1994 and 1992. Cover of *M. cavernosa* was higher in 1994 transects than in 1992. A significant bank by year interaction was observed in *Porites astreoides*. Accretionary growth rates of *M. annularis* were estimated from stations established during the 1994 field effort. Mean growth rates from 1994-1995 were similar to those estimated during the 1989-1991 monitoring study. Accretionary growth rates determined from sectioned coral core samples fell within the range of measurements derived from permanent growth station data during the 1994-1995 surveys. A new set of permanent stations for the measurement of encrusting growth of *D. strigosa* was established during the 1994 field effort. Estimates of encrusting growth rates of *M. annularis* were measured from 1992 station photographs only. Estimates of net encrusting growth rates of *D. strigosa* during the 1991-1992 period were substantially less than those estimated for the 1994-1995 period. Because of problems with the 1992 data and the resultant low sample size, it is possible that the differences may be an artifact of sampling error. As a result, statistical comparisons between 1991-1992 and 1994-1995 data were not conducted. Net encrusting growth rates of *D. strigosa* and the East and West Flower Garden Banks study sites were positive during the 1991-1992 period and 1994-1995 period were very close. Coral growth was clearly identifiable in 8 m<sup>2</sup> quadrat station images collected during 1992, 1994, and 1995, and included examples of both unimpeded encrusting growth and interspecific competition between several species. Number of observations of coral growth far exceeded observations of coral bleaching, disease, and retreat during this period. Occurrences of coral bleaching were much higher in quadrat images collected during the 1995 field effort than those from 1992 and 1994. Bottom temperatures measured on recording thermometers on the two study sites were in excess of 30°C during 1995. This period coincided with widespread coral bleaching on both study sites. Total daily irradiance and percent light transmission were recorded at both study sites in 1995. Temporal trends between the sites were quite similar, with slightly lower irradiance values collected at the deeper West Flower Garden Bank study site.

**STUDY PRODUCT:** Continental Shelf Associates, Inc. 1996. Long-term Monitoring at the East and West Flower Garden Banks. Final synthesis report for the U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. Contract No. 14-35-0001-30662. 112 pp.

\*P.I.'s affiliation may be different than that listed for Program Manager.