SASANHAYA BAY FISH RESERVE ANNUAL REPORT

INTRODUCTION

A Rota Local Senate Bill created the Sasanhaya Bay Fish Reserve (SBFR) in 1994. The SBFR was not managed as intended under that Bill until March 2000, when the Fisheries Research Section (FRS) of the Division of Fish and Wildlife (DFW) formally demarcated the boundaries of the SBFR with marker buoys, and conducted the first annual fish survey. Since that initial demarcation, marker buoys have been replaced on three separate occasions, with the aid of a local dive shop on Rota.

The SBFR has been sampled from 2000 to 2006, with the exception of 2003, when, following Typhoon Pongsana, the significant damage to the islands' infrastructure and operations prevented the DFW FRS from conducting the annual survey.

Enforcement of the SBFR has not fully attained the desired level of protection for the marine resources that live within and/or utilize the SBFR during part of their life cycle. Local residents as well as dive shop operators have reported numerous accounts of poaching within the SBFR boundaries to the DFW central office on Saipan since 2000. During the 2006 and 2007 surveys, DFW personnel observed fishing activity from the shoreline within the boundaries of the SBFR.

The SBFR lies on the SE corner of Sasanhaya Bay, where it is protected from the NE trade winds and open ocean waves. The habitat within the reserve consists of a reef slope that can be broken down into three types. The north end of the SBFR is characterized as a boulder zone with coralline algae and algal assemblages (Trianni & Moots 2000). The central part of the SBFR and the largest habitat type is characterized by extensive growth of *Porites rus* interspersed with coral massives and sand channels. The presence of extensive *Porites rus* colonies is indicative of an area that is significantly protected from windward ocean conditions. Part of this central section has been recovering from a CNMI Governor requested US Navy Explosive Ordinance Detachment detonation of unexploded ordinance in June 1996, that severely impacted the reef slope surrounding that detonation (Trianni 1998). The southern end of the SBFR is an inner point feature dominated by pavement habitat that is current swept and heavily influenced by open ocean waves and swell.

The geographic location of the SBFR, while protected from windward oceanographic influences, is vulnerable to Typhoon conditions, which advance to the Marianas from the SW. In addition to Typhoon Pongansa, which moved over Rota in December 2002, Typhoon Chataan and Typhoon Chaba impacted Rota, in July 2002 and August 2004, respectively.

METHODS

Mean abundances of fish were enumerated using 25 by 5 meter belt transects randomly placed within habitat types. Fish species within the transect boundary were identified by the same observer to the lowest possible taxonomic level and recorded on waterproof paper. This technique has been consistently used for all CNMI Marine Sanctuary surveys (Trianni 1999a &

1999b; Trianni 2003). Relative SBFR population estimates with bounds on error were generated using a stratified random sampling approach (Cochran 1977).

For year 2000, stratum weights were determined by simple proportional allocation of stratum size:

$$W_h = N_h/N$$

Where W_h is the stratum weight, N_h the stratum size, and N the sum of all strata. In subsequent years, allocation weights were optimally allocated, including stratum size and stratum variance:

$$W_h = \frac{N_h s_h}{\sum N_h s_h}$$

Where s_h is the estimated stratum variance. The sample size per strata was determined from the total sample size and the strata allocation weights:

$$n_k = W_h(n)$$

The unbiased estimate of the population mean was determined by:

$$\bar{y}_{st} = \sum^{L} (W_h)\bar{y}_h$$

The overall unbiased estimate of variance was determined as:

$$\hat{V}(\bar{y}_{st}) = \sum W_h^2 (\frac{s_h^2}{n_h})(\frac{N_h - n_h}{N_h})$$

The unbiased estimate of total population size was then calculated as:

$$\hat{Y} = N(\bar{y}_{st})$$

Bounds on the error of estimation were computed following Cochran (1977):

$$B = \pm 2\sqrt{\hat{V}(\hat{y})}$$

RESULTS

Relative population estimates are depicted in Figures 1-3. The following is an assessment of the changes in the 12 food fish groups analyzed for this report.

Lutjanidae. The relative abundance of snappers showed a decrease in 2007 following a marked increase during the 2006 survey period, exhibiting an overall positive trend during the 2000-2007 survey period (Figure 1). The most common species observed is *Apahreus furca*, the reef sivlermouth.

Lethrinidae. The relative abundance of emperors declined again during the 2007 survey period from the highest time series estimated abundance in 2005 (Figure 1). Over the 2000-2007 series the emperor estimates have shown an appreciable decline. Most observations of emperor in the SBFR have been *Gnathodentex aurolineatus*, a species that can be highly variable in abundance.

Myripristinae. Have exhibited a slight negative trend during the 2000-2007 survey period (Figure 1).

Holocentrinae. An upward trend was observed for this sub-family during the 2000-2007 survey period, although the estimates may be observable in the Holocentrinae (Figure 1). Species of the genus *Neoniphon* were most commonly observed.

Mullidae. The relative estimates of the goatfish over time show an upward trend for the 2000-2007 survey period and survey years 2002, 2006 and 2007 were the three highest relative estimates (Figure 2).

Balistidae. The estimated relative estimate average trend from 2000-2007 indicates a very slight increase over that period (Figure 2).

Serranidae. The relative population estimates of grouper show a steep increase during the 2000-2007 survey period. Observations of *Cephalopholus urodeta* and *Epinelphelus* spp. have increased in recent years, especially in 2007, which is the high for the survey period.

Nasinae. The estimated relative population three-year average from 2000-2007 indicates an obvious positive trend, primarily due to increased observations of Naso lituratus (Figure 2).

Sedentary Acanthuridae. The estimated relative population time series indicated an overall slight negative trend for the 2000-2007 survey period, although population estimates remain relatively high (Figure 3). The primary species in this group, *Ctenochaetus striatus* and *Acanthurus nigrofuscus*, are the numerically dominant species observed in the SBFR.

Roving Acanthuridae. The relative population estimated three-year average from 2004-07 indicates a substantial increase in comparison to the 2000-2002 average (Figure 3).

Scaridae. Both initial phase and terminal phase parrotfish indicate considerable positive trends during the 2000-2007 survey period (Figure 3). Relative population estimates for both phases were highest during the 2007 survey.

The graphs of relative population over the 2000-2007 survey period indicate obvious positive upward trends for the Lutjanidae, Mullidae, Nasinae, Serranidae, Roving Acanthuridae, Holocentrinae, and Initial and Terminal phase Scaridae. A slight upward trend was observed for

the Balistidae, Overall negative trends were evident in the Myripristinae (slight), Sedentary Acanthuridae (slight) and Lethrinidae (considerable).

DISCUSSION

Even with the lack of adequate enforcement in the SBFR, eight of the twelve groups indicated an upward trend over time, with the Balistidae trend being slightly positive. Four groups indicated a negative trend. There is no clear indication of the reasons for either trend, although there may have been a self-governed harvest restraint practiced by some percentage of the Rota fishing community, as well as rumor that "the poachers", who were "other Micronesians", left Rota due to economic difficulties. The presence of slight trends in many groups may be indicative of relatively stable populations for those groups. Considerable increasing trends appear for food primary fish groups such as the Lutjanidae and Scaridae, and this may be due to decreased fishing pressure. A more comprehensive analysis of trends will be conducted which will include precision and power analysis for the elucidation of statistical significance.

A solid six years of data have been collected from the SBFR, and indications thus far are positive for over half of the main food fish groups analyzed in this report. Continuation of the surveys over time, coupled with an increased enforcement presence, will serve to aid in discerning between natural variability and statistically significant trends.

LITERATURE CITED

Cochran, W G (1977). Sampling Techniques. 3rd ed. John Wiley and Sons, New York, 428pp.

Trianni MS 1998. Qualitative Assessment of World War II Ordinance Sites in Coral Reef Habitats at the Island of Rota: A Historical Record. CNMI DFW Technical Assistance Report 98a. 18 pp.

Trianni MS 1999a. Estimation of reef fish abundance and benthic habitat composition in the proposed Managaha Marine Conservation Area. CNMI DFW Technical Report 99-03. 16 pp.

Trianni MS 1999b. Estimation of reef fish abundance and documentation of habitat characteristics in the proposed Tinian Marine Sanctuary. CNMI DFW Technical Report 99-02. 22 pp.

Trianni MS & KM Moots. 2000. An initial survey of the Sasanhaya Fish Reserve, Rota (CNMI). CNMI DFW Technical Report 00-03. 26 pp.

Trianni MS. 2003. Determining Reef Fish Abundance in Marine Protected Areas in the Northern Mariana Islands. In: "Aquatic Protected Areas – What works best and how do we know?", Proceedings of the World Congress on Aquatic Protected Areas - 14-17 August, 2002; Cairns, Australia. (Eds J. P. Beumer, A. Grant and D. C. Smith). pp. 366-376. (University of Queensland Printery, St Lucia: Queensland).

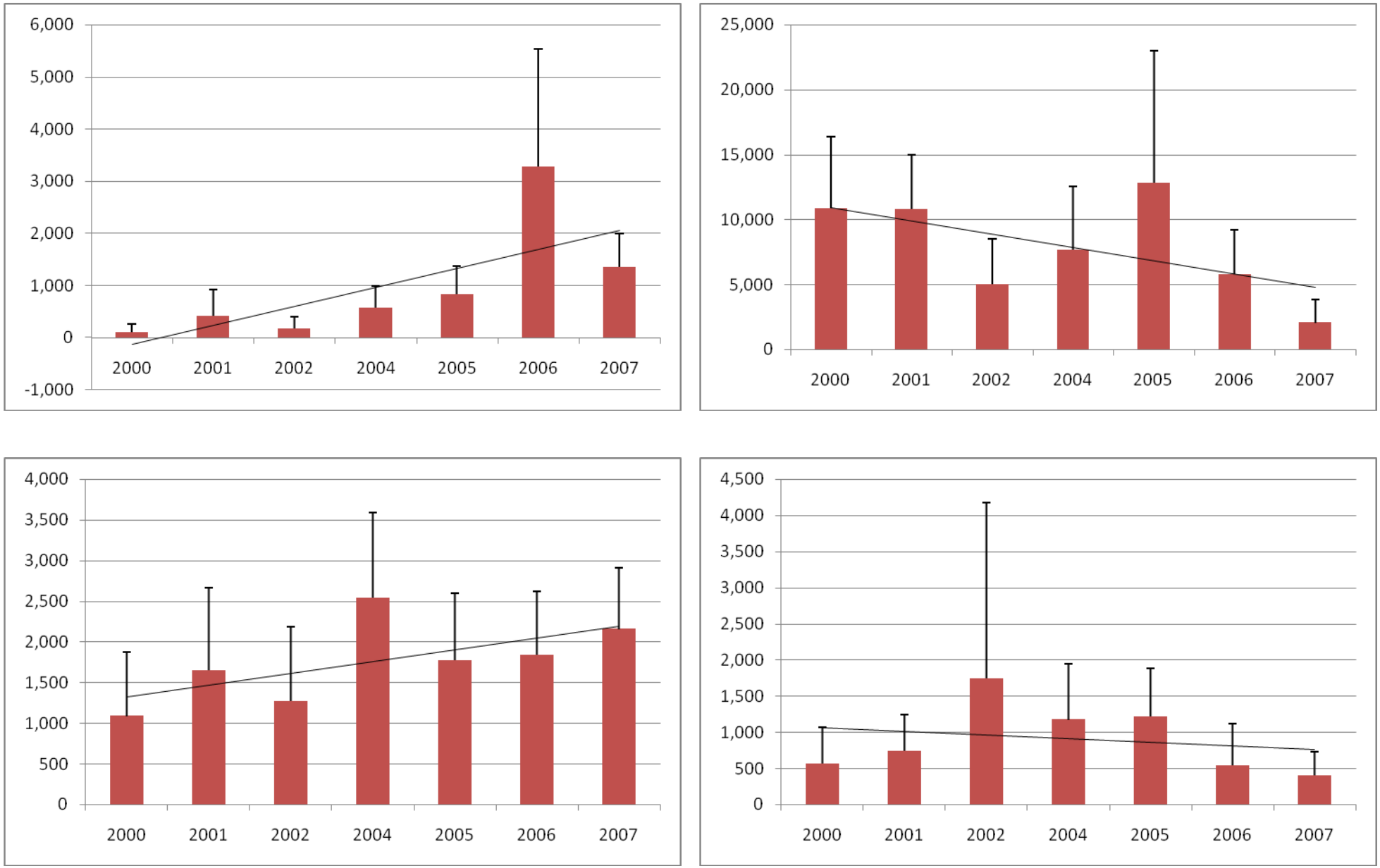

Figure 1. Relative population estimates with error bounds derived from stratified random sampling. Clockwise from top left: Lutjanidae; Lethrinidae; Myripristinae; Holocentrinae.

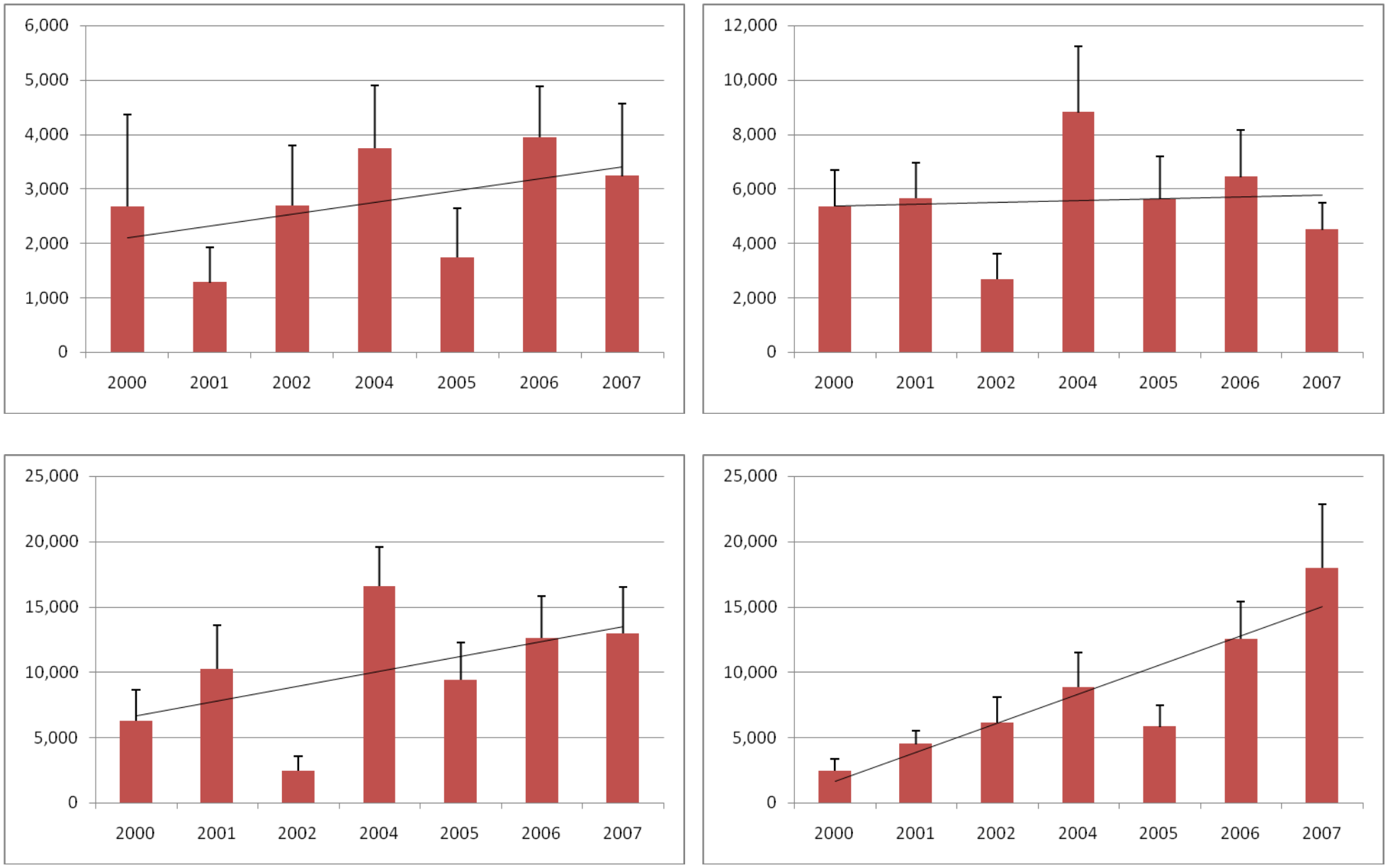

Figure 2. Relative population estimates with error bounds derived from stratified random sampling for belt transect samples. Clockwise from top left: Mullidae; Balistidae; Serranidae; Nasinae.

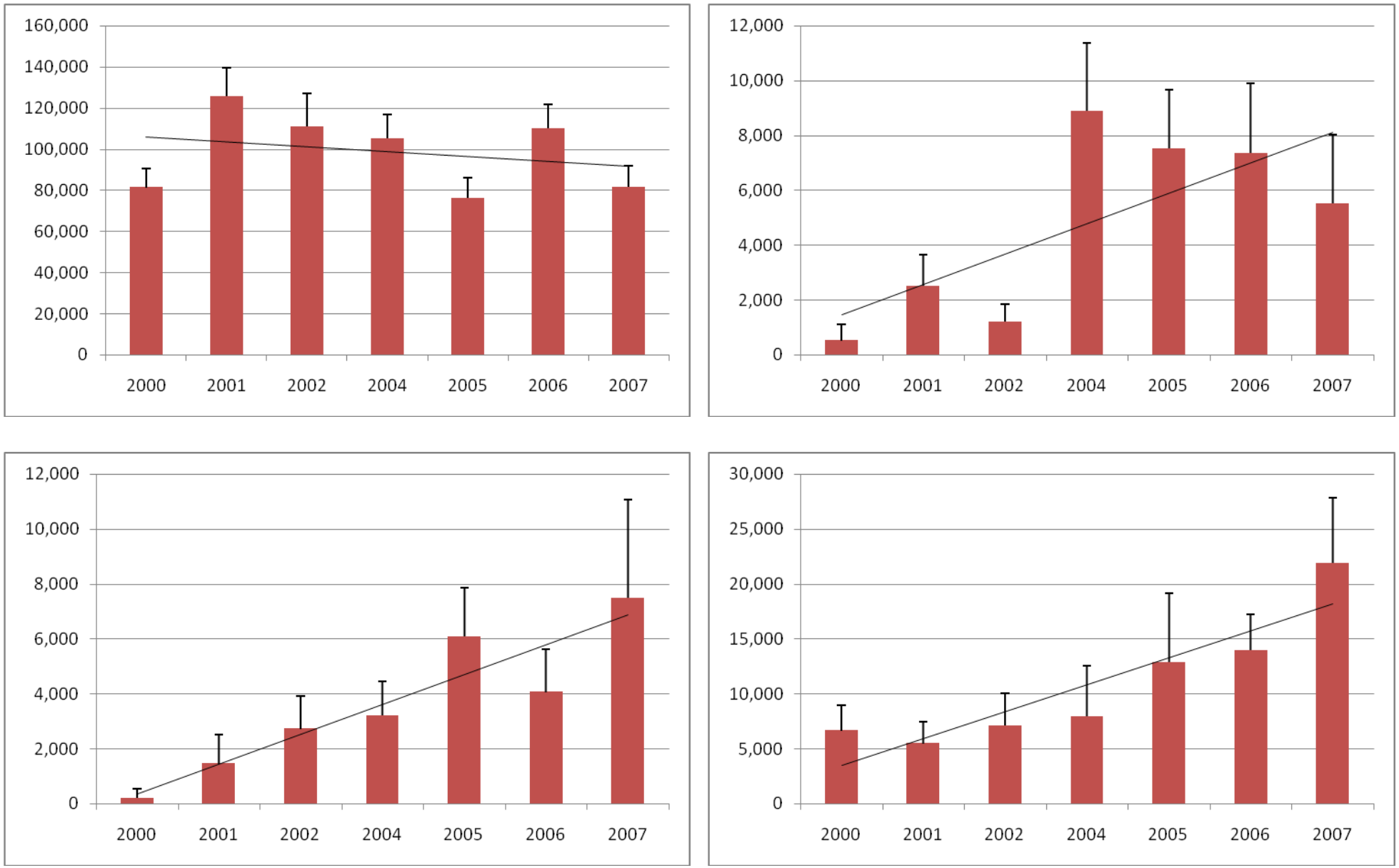

Figure 3. Relative population estimates with error bounds derived from stratified random sampling. Clockwise from top left: Sedentary Acanturinae; Roving Acanthurinae; Initial phase Scaridae; Terminal phase Scaridae.