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# Training on the use of CMSY

for the assessment of Indian fish stocks in a data-poor environment

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Central Marine Fisheries Research Institute, Kochi, Kerala, India



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Maria Lourdes D. Palomares

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Q-quatics Technical Report No. 2

## REPORT ON THE ANALYSIS OF *SAURIDA UNDOSQUAMIS* USING CMSY/BSM<sup>8</sup>

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### Introduction

The brushtooth lizardfish, *Saurida undosquamis*, is a commercially important demersal fish resource along the southeast coast of India (see Figure 1). The species ranges in distribution from the eastern Indian Ocean to southwestern Australia (Russell, 1999). It is an active, voracious predator feeding on fishes particularly those inhabiting demersal and mesopelagic waters. It also feeds on shrimp and squid. Cannibalism is prominent. Sexes are separate, and spawning is seen year round, with a prominent peak during Oct-Dec in the region (Kadharsha *et al.*, 2013). The resource is primarily consumed fresh in the region. The stock of *S. undosquamis* along the east coast of India is considered to be a single stock. Mechanized trawlers operating in the region take this resource. The trawl fleet operating off Chennai covers an area from Nizamapatnam in the north to Nagapattinam in the south.



**Figure 1.** Landings of brushtooth lizardfish, *Saurida undosquamis*, from the southeast coast of India. Photo by Dr. T.M. Najmudeen (CMFRI).

### Methods and Data

For the purposes of the CMSY training workshop, we used trawl fishery landing of *S. undosquamis* (in tonnes) and fishing effort data (in actual fishing hours) from Chennai for the years 1987-2009 (CMFRI). The data was collected following the Stratified Multi-stage Random Sampling method (Srinath *et al.*, 2005). The catch per unit effort (CPUE) in kg/h was estimated by dividing the landings (in kg) with the fishing hours. Both the landings data and CPUE data was used for the analysis.

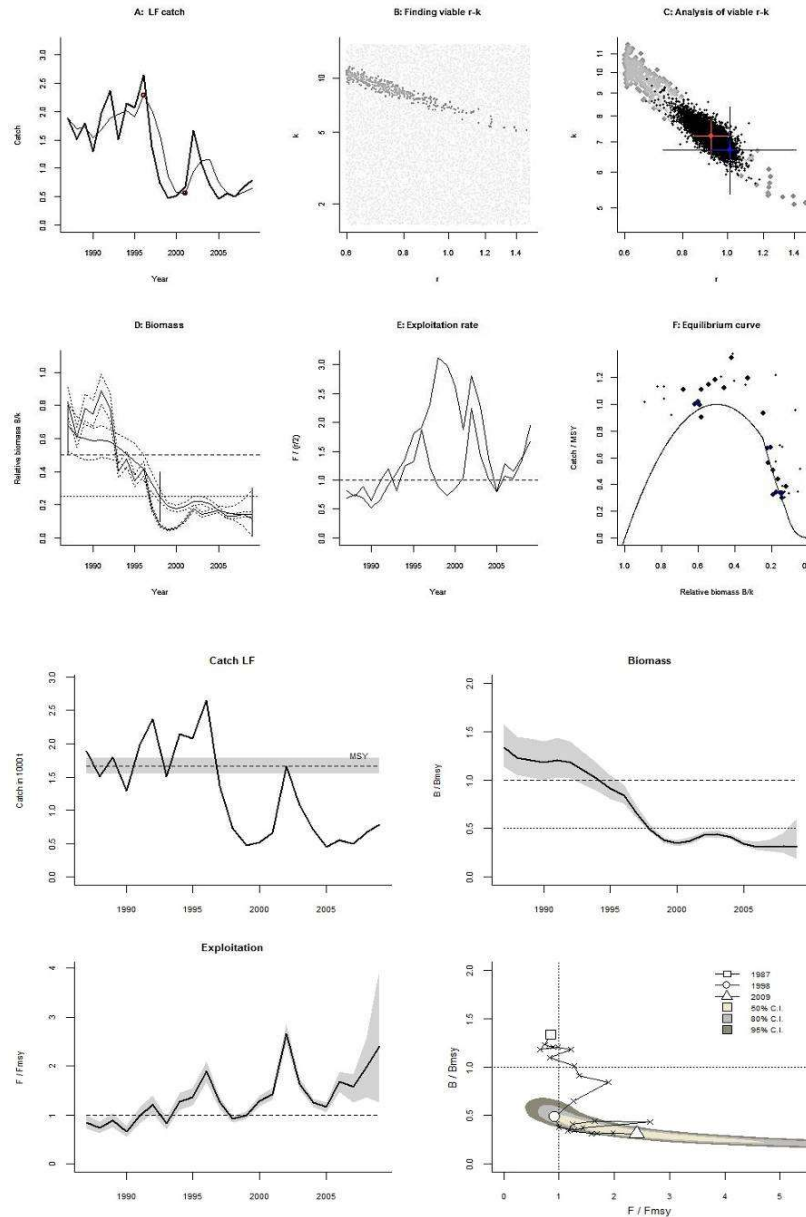
### Results and Discussion

Landings of *S. undosquamis* by mechanized trawlers operating off Chennai ranged from 454 t (2005) to 2645 t (1996). The average landing during the time period was 1277 t. CPUE ranged from 0.4 kg/h to 7.5 kg/h with an average of 2.9 kg/h. Landings showed a declining trend overall with a sharp decline from 1995 to 1999. During the 1980s, lizardfish contributed nearly 10-11% of trawl landings at Chennai, which subsequently fell to about 2-3% during the 1990s.

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Prior to 1990, *S. undosquamis* was the sole species of lizardfish landed at Chennai. Since then, the contribution of the species to lizardfish landings at Chennai fell continuously and by 2009 it formed only 27% of lizardfish landings.



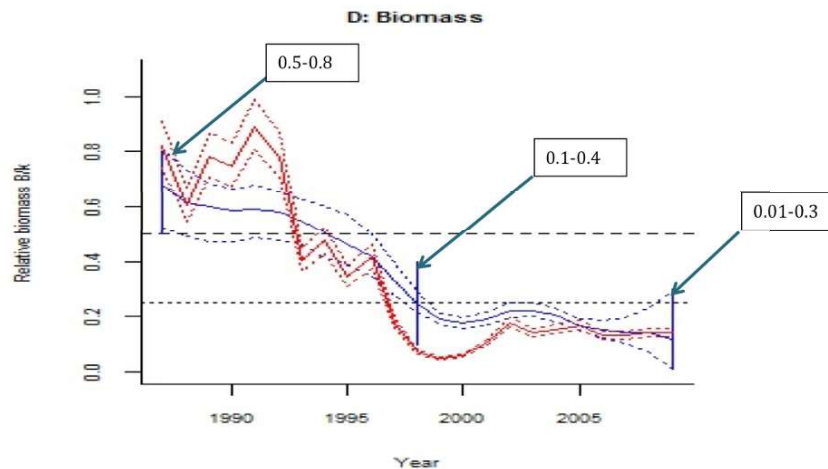
**Figure 2.** Results of the CMSY/BSM analyses for the brushtooth lizardfish, *Saurida undosquamis*, from the southeast coast of India. Upper panel: Fitting of  $r$  and  $k$  priors to the catch and catch-per-unit-of-effort data. Lower panel: management analyses based on BSM. Results for management based on BSM analysis:  $F_{msy} = 0.461$ , 95% CL = 0.413 - 0.515 (if  $B > 1/2 B_{msy}$  then  $F_{msy} = 0.5 r$ );  $F_{msy} = 0.289$ , 95% CL = 0.259 - 0.323 ( $r$  and  $F_{msy}$  are linearly reduced if  $B < 1/2 B_{msy}$ );  $MSY = 1.66$ , 95% CL = 1.55 - 1.78;  $B_{msy} = 3.61$ , 95% CL = 3.26 - 3.99; Biomass in last year = 1.13, 2.5th perc = 0.688, 97.5 perc = 2.16;  $B/B_{msy}$  in last year = 0.314, 2.5th perc = 0.191, 97.5 perc = 0.6; Fishing mortality in last year = 0.696, 2.5th perc = 0.364, 97.5 perc = 1.15; Exploitation  $F/F_{msy} = 2.4$ , 2.5th perc = 1.26, 97.5 perc = 3.96.

## Output of CMSY Analysis

The results (see Figure 2) suggest declining catch and declining stock. The current  $F$  is always higher than the  $F_{msy}$ , with  $F/F_{msy}$  increasing from 1 to 3. The biomass is initially higher than the  $B_{msy}$ , but then decreases and falls below  $B_{msy}$ , with  $B/B_{msy}$  ratio decreasing from 1.3 to 0.4.

The initial range of biomass set to 0.6–0.8 seems reasonable as the catch was high in the initial years and the resource has been an important component of trawl catches in past years. The intermediate biomass set to 0.1–0.4 at the intermediate year 1998 is also acceptable, as the catch had started declining gradually. The final biomass of 0.01–0.3 is also acceptable as the catch continued to decline.

The data presented is for the period 1987–2009. Post 2009, the catch of this species continued to decline, and it currently contributes to 1–2% of the lizardfish landings in Chennai. The mean size of the species in the fishery has also declined from 190–200 mm to 150–160 mm, and there has been an increase in the quantum of juveniles landed. This could also have contributed to the decline in landings.



**Figure 3.** Details of the biomass priors used as input parameters in the CMSY/BSM analysis of *Saurida undosquamis* from the southeast coast of India.

## Management Suggestions

It is evident that the stock has declined considerably over the 21-year time period, which calls for serious and immediate fishery management actions, which can include:

- Minimum legal size at capture;
- Mesh size regulation;
- Demarcation of juvenile grounds for seasonal closures;
- Reduction in fishing effort.

However, this resource is not a targeted one and management actions need to be interpolated to measures derived for other important commercial resources. Thus, mesh size regulation and reduction in fishing effort would be subject to parallel



management needs for other resources, and would have to be part of a multispecies fishery management module.

The role of *S. undosquamis* in the trophic network would also have to be considered to understand the impact of its removal from the ecosystem on other resources, and the imbalance created by changes in its abundance.

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