SOUTHWEST FISHERIES SCIENCE CENTER
FIRST AND SECOND QUARTER REPORT - FY 2004
For the Period October 1 - March 31

Submitted by: Roger Hewitt, Division Director, Fisheries Resources Division

Title of accomplishment or milestone: Background technical analysis on tuna purse seine fishing capacity for the second meeting of the Technical Advisory Committee for the FAO project, "Management of Tuna Fishing Capacity: Conservation and Socio-Economics," held in Madrid, 15-18 March, 2004.

Current status: The analysis was completed and presented to the meeting.

Background: Tuna purse seine fleets fish throughout the globe, in the areas managed by ICAAT, IATTC, IOTC, and the new Western and Central Pacific convention. The present tuna fishing capacity is in excess of sustainable target levels of yield for at least some species and resource stocks. Measures of excess capacity, the difference between capacity output and observed output, and overcapacity, the difference between capacity output and a measure of sustainable target yield, were necessary to document the extent of the fishing capacity issue and to help set the basis for subsequent management recommendations. To tackle these issues, the main objectives of the project were to identify, consider, and resolve problems associated with the management of tuna fishing capacity on a global scale, taking into account conservation and socio-economic issues.

Purpose of activity: Jim Kirkley, Chris Reid, and Dale Squires, with assistance from Jun Ye, developed the background paper, "An Analysis of the Fishing Capacity of the Global Tuna Purse Seine Fleet," and presented the empirical results at the 15-18 March, 2004 meeting in Madrid to measure and document the excess capacity and overcapacity (when sustainable target levels of catch were available) in the global tuna purse seine fleet for yellowfin, bigeye, and skipjack tunas in the Atlantic, Indian, Eastern Pacific, and Western and Central Pacific Oceans, and albacore tuna in the Atlantic and Indian Oceans.

Description of accomplishment and significant results: Fishing capacity and capacity utilization of tuna purse seine vessels in the Atlantic, Indian, Eastern Pacific, and Western and Central Pacific Oceans was estimated by Data Envelopment Analysis (DEA), allowing for variable returns to scale and controlling for resource stock levels and sea surface temperature, given the capital stock of vessels. The capacity output was adjusted for technical efficiency, so that differences in capacity output among tuna purse seine vessels of a comparable capital stock was due entirely to differences in employment of variable inputs, such as the number of sets.

In the EPO, vessel-level data were obtained from the IATTC for landings, effort, and vessel sizes for the three prevalent methods of tuna fishing, setting on dolphins, floating objects, and unassociated schools. Output were specified as average landings per set per vessel per year for 6 distinct outputs: yellowfin and bigeye tunas together and skipjack tunas separately for each of the three methods of fishing. The data were also differentiated by vessel size class (measured by carrying capacity in metric tons) as follows: class 2 and 3 vessels with 28 vessels, class 4 and 5 vessels with 43 vessels, and

class 6 vessels with 188 vessels. Classes 2 and 3 vessels and classes 4 and 5 vessels were combined to provide an acceptable number of observations in each size grouping to be able to make the DEA estimates. Biomass estimates for yellowfin, bigeye, and skipjack tunas were provided by the IATTC and measures of sea surface temperature were obtained from Rayner *et al*. (2003) for 5-20°N to capture environmental influences. Data were obtained for 1980-2002, but DEA estimates of capacity output were made for only 1998-2002 to try to control for changes in fishing capacity due to technical change and productivity growth in general. Annual fishing capacity measures for the entire EPO were obtained from the set, and vessel-level estimates by the number of vessels and sets in each year for each vessel and set type class.

In the EPO tuna purse seine fishery, excess capacity (capacity output less observed output or landings), purged of technical efficiency, was found for all vessel size classes individually and combined for all set types (dolphin, floating objects, unassociated schools). EPO tuna purse seine vessels had the capacity to catch substantially more of all three species over 1998-2002 than they actually caught. Class 6 vessels were the largest contributor to excess capacity, although there was excess capacity for class 2 and 3 vessels and class 4 and 5 vessels. Excess capacity for all three species combined, purged of technical efficiency, fluctuated from a minimum of 120,420 mt in 1998 to a high of 208,162 mt in 1999, dipping in 2000 and steadily rising to 193,199 mt in 2001 and 196,178 mt in 2002. For class 6 vessels, excess capacity for yellowfin and bigeye, purging capacity output of technical efficiency, was the greatest for dolphin sets, followed by unassociated sets, and then by school sets. For skipjack, this excess capacity is highest for floating object sets, followed by school sets, and least for dolphin sets. Average excess capacity over 1998-2002, purged of technical efficiency, for all vessel classes is highest for dolphin sets at 71,063 mt per year, followed by sets on floating objects at 61,462 mt per year, and followed by school sets at 23,009 mt per year. Excess capacity, purged of technical efficiency, for all vessel size classes and set types has roughly trended upward over 1998-2002, but with considerable variability.

In the EPO tuna purse seine fishery, overcapacity (capacity output less average maximum sustainable yield) for yellowfin and bigeye tunas combined, purged of technical efficiency, was relatively small in 1998 at 37,167 mt or approximately 11 percent more than the combined AMSY. Overcapacity, purged of technical efficiency, rose to 92,518 mt in 1999 (about 27 percent more than the combined AMSY), dipped slightly to 89,704 mt in 2000 (about 26 percent more than the combined AMSY), and climbed precipitously to 210,915 mt in 2001 (about 61 percent more than the combined AMSY), and rose still further to 241,835 mt in 2002 (about 70 percent more than the combined AMSY). In all cases, class 6 vessels contributed the lion's share of overcapacity.

Significance of accomplishment: The technical analysis on tuna purse seine fishing capacity will help to identify, and resolve problems associated with the management of tuna fishing capacity on a global scale, taking into account conservation and socio-economic issues.

Problems: None

Contact: Dale Squires, (858) 546-7113