

### III. WORKSHOP BREAKOUT SESSIONS AND RECOMMENDATIONS

Following the plenary session, the Symposium broke into two workshops: *Stock Assessment and Management* and *Ecosystem Consequences*. The groups were guided by the following:

- Develop recommendations on the formation of a coastwide network for modeling the dynamics of the sardine and monitoring their movements, geographic variation in vital rates, age structure, and abundance.
- Evaluate the potential ecosystem effects of the sardine outburst and determine the optimal research strategy for estimating the consequences of shifts in ecosystem dominance of sardine.
- Fishery/Economics and Management: Evaluate the economic value of sardines and potential value markets, ecological and management influences on markets.

#### ***STOCK ASSESSMENT AND MANAGEMENT WORKSHOP***

**John Hunter and Doyle Hanan, Chairs**

Sardine fisheries exist once again along the entire coast of North America from Baja California Mexico to British Columbia, Canada. An accurate coast wide assessment of this widely distributed stock is not possible at present for a variety of reasons: 1) the fishery independent measures of abundance cover only a fraction of the full range of the population; 2) the sardine fishery takes only a near-shore, often younger, fraction of the stock leaving the offshore fraction, of presumably larger and older fish, un-sampled; 3) age and growth measurements are confounded by movements along the coast which are presently largely unknown; and 4) basic life table information are lacking or need validation. The group discussed a variety of measurements and monitoring approaches that would help remedy the situation but set no priorities (Table 1). It was considered unlikely that new money would be available to expand the extent of coastal monitoring and research on sardine throughout its range. Thus, future advances in stock assessment will depend upon pooling of information, and in-kind contributions from industry and fishery agencies. In this regard, U.S. and Canadian Fishing Industry representatives expressed a willingness to contribute to the coast-wide collection of information needed to assess the sardine population. Since neither the Mexican sardine industry, nor the Instituto Nacional de Pesca (INP) attended this session, the extent of their interest in this international collaboration is not known. Mexican academic scientists who attended the session strongly supported such an international collaborative approach.

The consensus of the workshop was that an international forum was needed to implement and coordinate coast wide collection of the data for sardine stock assessment, and to exchange information, and keep abreast of trends in the fishery. The forum, called here FISCIE for Forum

for International Sardine Collaboration and Information Exchange, should have regularly scheduled annual meetings and be attended by industry, fishery agency and academic scientists from Canada, Mexico and the U.S. FISCIE would establish collaborative protocol, facilitate in-kind contributions from industry, share and archive information, coordinate coast-wide sampling periods or surveys involving industry and agencies, share and discuss the most recent stock assessment information, and provide coast-wide standards for measurements. An *ad hoc* steering committee was established for organizing the first meeting of FISCIE (Table 2).

Another issue discussed in this breakout group was the need to modernize the U.S. sardine fleet. Fleet modernization is needed for the fleet to meet Hazard Analysis Critical Control Point (HACCP) requirements, meet new environmental requirements such as a sea disposal of transport water, and to produce a higher quality and more valuable product. While fleet modernization is primarily a U.S. industry matter, beyond the scope of Sardine 2000, two appropriate science policy issues were identified. First, when control rules are considered for the sardine fishery by U.S. management, the need for fleet modernization should be considered as a value as well as the traditional conservation-based value of reducing fishing effort. The group recommended that this report draw attention to this issue to scientists and managers involved in U.S. Coastal Pelagic Fish Management. Secondly, it would be advantageous to consider upgrading the collection of fishing information using shipboard electronic data logging systems as part of such a fleet modernization program. Presently, agency biologists are working with data collecting systems as obsolete as the fishing vessels.

## **ACTION ITEMS**

### 1) Convene first meeting of FISCIE.

The goal of the first meeting shall be to identify and implement collaborative data collection for coast-wide stock assessment of sardine. The meeting shall be convened in 2000 and shall:

- Elect a chair and establish meeting procedures.
- Hear views of INP and Mexican sardine industry regarding joining FISCIE.
- Inventory all west coast sardine data sources.
- Identify and set priorities for new information collection.
- Implement a coast-wide (US, Mex., and Can.) data collection initiative for 2001.
- Establish an electronic reporting and information system.
- Present and discuss latest stock assessments.
- Exchange information on trends and events in the fishery.

2) Implement Coast-wide collection of oil yield data. The oil yield of sardines routinely estimated by processors, could provide a valuable time series for monitoring the condition of the stock, if the data were routinely archived, and the methods presently employed were intercalibrated. Steps shall be taken to begin this process.

**Table 1.** Research activities suggested by the working group that would increase coast-wide knowledge of sardine needed for a coast-wide stock assessment. Practicality of items were not determined and no priorities were set; items are listed in no particular order.

Increase sampling for age structure in northern and southern end of the range.

Convert Oregon-Washington egg surveys carried out by NWFSC to biomass by estimating adult parameters (batch fecundity and spawning frequency).

Improve existing southern California spawning biomass estimates based egg surveys by measuring adult spawning parameters (batch fecundity and spawning frequency).

Conduct aerial surveys of sardine schools using spotter pilots to provide coast wide indices of sardine abundance and estimate the extent of offshore distribution.

Add airborne school detection using lidar to the above aerial surveys.

Conduct coast wide inventory of sardine biomass using CUFES.

Conduct acoustic-trawl survey coast wide to provide coast wide estimate of biomass.

Carry out an industry/agency tagging program using conventional tags or button archival tags. (Idea not well supported by group because of expected low return rates and costs).

Conduct a coast-wide intensive sampling periods using industry and multiple agency contributions resembling the URICA biomass surveys of Peru, except the focus would be on age structure and reproductive rates. One suggestion was to focus on the April since the April CalCOFI survey provides the longest fishery independent time series for sardine; a summer focus would also be useful since the northern fishery occurs in the summer.

Conduct short fishing vessel cruises to establish offshore limit to sardine distribution and to obtain age structure information.

Examine micro-constituents of sardine otoliths to determine the origins of fish (a low cost alternative to tagging).

Implement electronic logbooks with GPS and time stamp to improve locality and time data on catches.

Establish a network to archive industry derived estimates of size specific oil yield to be used in estimating seasonal reproductive output of stock.

Investigate feeding selectivity and the role of diet to determine the causal factors of bursting abdomens (the hot tummy phenomena).

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