It has been just over 14 years since the completion of the Eastern Caribbean Flyingfish Project (ECFFP). This book brings together all of the various research and advice that was generated by that project. At the end of the ECFFP the group produced a list of ‘further research requirements’ deemed to be important for refining and distinguishing among the management options that are presented in Chapter 25 (Table 1). A few of these have been addressed since then. There have also been two main efforts to move forward with management of eastern Caribbean flyingfish.

PROGRESS WITH RESEARCH

From 1995 to 1999 the Centre for Resource Management and Environmental Studies (CERMES) at the University of the West Indies, Barbados had a research programme on flyingfish population genetics that resolved the geographic ranges of the stocks and with whom they are shared. Key outputs of this research have been included in this volume (Chapters 19 and 20). The findings indicate three genetically discrete subregional stocks of *H. affinis* located in the eastern Caribbean, the southern Netherlands Antilles and off NE Brazil (Gomes *et al.* 1998, Gomes *et al.* 1999). However, indications of partially restricted gene flow both spatially and temporally within the eastern Caribbean stock, suggest that there may be different spawning groups which need further investigation (Gomes *et al.* 1998).

The existence of an eastern Caribbean management unit for *H. affinis*, was recognised at the final workshop for the Eastern Caribbean Flyingfish Project in Barbados, 1992 (Oxenford *et al.* 1993) and by the WECAFC Working Party on Marine Resources in Belize City 1997 (FAO 1998). This was based on: Tagging studies that suggest a single stock moving throughout the eastern Caribbean area (Dominica to Trinidad and Tobago); Genetic analyses that suggest that the eastern Caribbean stock is separate from stocks around Brazil and Curaçao.

The longevity of *H. affinis* in the eastern Caribbean has now been confirmed to be less than 2 yr in a study using radiochemical dating techniques (Campana *et al.* 1993), allowing a refinement of the adult growth rates.

The trophic relationship between flyingfish, other forage species and larger oceanic pelagic species is currently under investigation as a part of the FAO Lesser Antilles Pelagic Ecosystem (LAPE) Project (FAO 2007).

MANAGEMENT INITIATIVES

The Pelagic and Reef Fishes Subproject of the CARICOM Fisheries Resource Assessment and Management Programme (CFRAMP) included an activity to address aspects of eastern Caribbean flyingfish. At the Small Coastal Pelagic and Flyingfish Subproject Specification Workshop (SSW) in Grenada in 1996, papers were presented reviewing the status of flyingfish fisheries and outlining proposed research and management activities for flyingfish. These activities were not carried out owing to lack of funding. The contributions to the SSW, although not published, address a number of topics that deserve attention: biology, life history and ecology (Nakashima 1996a, Monteiro *et al.* 1996, Singh-Renton 1996), social science (McConney 1996), fishing practices (Mohammed 1996), fishery assessment and management (Cochrane 1996, Nakashima 1996b). Country reviews presented at this workshop also provide another waypoint in the description of national fisheries for flyingfish.

In 1997 WECAFC established an *Ad Hoc* Flyingfish Working Group that has met twice in Barbados: September 1999 (FAO 1999) and January 2001 (FAO 2002). At the first meeting an analysis of catch and effort data from five countries over the period 1982-1998 was carried out, but the data did not show any trends and were considered inadequate for analysis (FAO 2002). The WG identified three activities that
should be pursued towards the cooperative management of the eastern Caribbean flyingfish stock:
1. Analysis of fishery catches and fishing effort
2. Review of social and economic aspects
3. Preparation of a Regional Fisheries Management Plan (FMP).

At the second meeting of the WG in 2001, re-analysis of catch and corrected effort data was attempted in a workshop setting, but the data for all islands except Barbados were confounded by an inability to distinguish between vessels that targeted flyingfish and those that did not (FAO 2002). Some of the sociological information on the flyingfish fishery identified at the first meeting as being needed, was collected and presented at the second working group meeting in 2001 (FAO 2002). Country fishery updates presented at both WG meetings provide the most recent information on the fisheries (FAO 1999, 2002). The regional FMP was developed in draft form and remains to be reviewed and adopted (Oxenford 2002).

In the meantime, access to flyingfish stocks continues to be a contentious issue between Barbados and Trinidad and Tobago. Much of the contention appears to centre on perceptions of trade rather than scientific issues. The results of the ECFFP were a major component of the information synthesised in the first months of 2003 by the Joint Technical Working Group (JTWG) established by these two governments to put together the best available body of information on this fishery. Still lacking is an appropriate governance mechanism for the resource. The JTWG and the WECAFC WG provide the opportunity for exchange and synthesis of technical information, although the former involves only two of seven states involved in the fishery, but there is still no appropriate forum for decision-making for this fishery.

### Table 1. Research needs for further development of a regional management plan for flyingfish in the eastern Caribbean, as determined at the final workshop of the ECFFP (Oxenford et al. 1993).

<table>
<thead>
<tr>
<th>Research Area</th>
<th>Priority</th>
<th>Time Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimate flyingfish biomass used as bait to support other fisheries (particularly important in Grenada)</td>
<td>Medium</td>
<td>Long-term</td>
</tr>
<tr>
<td>Estimate mortality factors on flyingfish (e.g. predation mortality on spawners)</td>
<td>Medium</td>
<td>Long-term</td>
</tr>
<tr>
<td>Obtain more information on Curacao flyingfish fishery</td>
<td>High</td>
<td>Short-term</td>
</tr>
<tr>
<td>Investigate alternative spawning habits of flyingfish to determine if i) spawn on surface substrata causes them to sink, ii) benthic spawning occurs</td>
<td>Medium</td>
<td>Short-term</td>
</tr>
<tr>
<td>Investigate the frequency and duration of spawning of individual fish relative to the spawning season</td>
<td>Medium</td>
<td>Long-term</td>
</tr>
<tr>
<td>Investigate relationship/biotic dependency of large pelagics on flyingfish</td>
<td>High</td>
<td>Long-term</td>
</tr>
<tr>
<td>Obtain accurate CPUE data throughout region, including i) estimate of time/effort spent specifically targeting flyingfish, and ii) effects of gear competition on current catch rates</td>
<td>High</td>
<td>Long-term</td>
</tr>
<tr>
<td>Standardise effort data throughout the region by calculating fishing power conversion factors for the different vessel types exploiting flyingfish</td>
<td>High</td>
<td>Long-term</td>
</tr>
<tr>
<td>Pursue investigation of effect of oceanographic and biotic variables on stock-recruitment relationship to improve yield predictions</td>
<td>Medium</td>
<td>Long-term</td>
</tr>
<tr>
<td>Improve crude abundance estimate through i) investigation of flyingfish depth distribution and proportion of school flying at approach of a survey vessel, and ii) more tagging</td>
<td>High</td>
<td>Long-term</td>
</tr>
<tr>
<td>Refine risk assessment model to include new information</td>
<td>High</td>
<td>Short-term</td>
</tr>
<tr>
<td>Check correlation between adult abundance, as indicated by visual survey data, and catch rates obtained in same area on same day</td>
<td>High</td>
<td>Short-term</td>
</tr>
<tr>
<td>Examine mobility of centres of abundance</td>
<td>Medium</td>
<td>Long-term</td>
</tr>
<tr>
<td>Explore feasibility of commercial exploitation of <em>Parexocoetus brachypterus</em></td>
<td>Low</td>
<td>Long-term</td>
</tr>
<tr>
<td>Conduct comprehensive socioeconomic study of the flyingfish fishery</td>
<td>High</td>
<td>Long-term</td>
</tr>
<tr>
<td>Refine growth rate estimates of older fish</td>
<td>High</td>
<td>Short-term</td>
</tr>
<tr>
<td>Investigate flyingfish patch characteristics (e.g. causes and implications for catch rates)</td>
<td>High</td>
<td>Short-term</td>
</tr>
</tbody>
</table>
There are plans for the Caribbean Large Marine Ecosystem (CLME) Project to take up the challenge of regional level management of flyingfish fisheries (Fanning et al. 2007). The CLME Project has a focus on governance of transboundary living marine resources and will pursue these within a LME governance framework (Fanning et al. 2007).

REFERENCES


