National Report: Update on tuna fisheries of Taiwan in the Pacific Region

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Introduction

The Pacific Ocean is one of the earliest fishing grounds exploited by Taiwanese tuna fishery. Currently, there are three types of tuna fisheries operating in this region: the frozen tuna longline (FTLL) fishery, the distant-water purse seine (DWPS) fishery and the fresh and/or chilled tuna longline (CTLL) fishery based upon how the catches were stored (chilled or frozen), or gear types and the vessel sizes.

The frozen tuna longline (FTLL) fishery

The FTLL vessels refer to those vessels mostly greater than 100 GRT and operating in distant waters of foreign EEZ and high seas. Number of FTLL vessel in the Pacific Ocean in 2001 was estimated to be about 100. Most of these vessels historically targeted on albacore for canning, but in recent years, some vessels also targeted on bigeye and yellowfin tunas for Japanese frozen sashimi market.

The major fishing grounds of FTLL vessels were located in the South Pacific and the tropical region (Figure 1). However, in recent years, the North Pacific has become increasingly important as some of the vessels start to target on northern albacore on seasonal basis.

Table 1 shows the catch estimate of major tuna and tuna-like species caught in FTLL fishery during 1997-2001 period. The most dominant species caught was albacore, accounting for about 73% of the total catch.
during this period (Figure 2). Bigeye and yellowfin tunas together accounted for another 20%. Catch of other species was only 6% (in terms of quantity). The average catch in recent 5 years (1997-2001) was about 19,000 mt for albacore, 3,000 mt for bigeye, and 2,000 mt for yellowfin tuna. There was an obvious increase in catch of tropical tunas in 2001, presumably resulting from an increase in number of vessels equipped with super-cold freezer (i.e. –50 ~ -60°C) and targeting on bigeye and yellowfin tunas in the region.

The distant water purse seine fishery

Purse seine fishery was introduced into Taiwan in 1982. Since then, it has become one of the major fishing gears used in Taiwanese tuna fishery. Total number of purse seine vessel in 2001 is 41, of which 18 are greater than 1000 GRT and 23 between 500 and 1000 GRT.

Total catch and major species caught in this fishery during 1997-2001 period were shown in Table 2. The most dominant species remained to be skipjack, accounting for about 77% of the total catch (Figure 3). Yellowfin tuna was the 2nd dominant species accounting for another 22%, and the bigeye tuna only accounted for 1% of the total catch. Average catch during this period was about 169,000 mt for skipjack, 48,000 mt for yellowfin and 1,600 mt for bigeye tuna. In addition, catch of skipjack in 2001 decreased by about 6% (12,000 mt), but catch of yellowfin and bigeye tunas increased by about 19% (7,274 mt) and 20% (384 mt), respectively. Such a change may have been related to differences in major fishing grounds located.
The major fishing grounds of DWPS fishery varied dynamically in this period (Figure 4). After 1998, fishing grounds started to move westward and mainly located in the western and central part of the tropical Pacific (135-175°E, 8°N-8°S) with sporadic efforts concentrated in areas east of 180°E. The fishing grounds in 2000 essentially located only in areas west of 180°E. However, in 2001, fishing grounds extended to as far as 166°W due possibly to the impact of El Niño.

Figure 5 shows the comparisons of CPUE (mt/set) and total catch among fishing areas. The CPUE, in general, fluctuated between 20 and 40 mt/set among fishing areas from 1997 to 2001. The major catches were in PNG, high sea, FSM and Kiribati. The catch in these areas accounts for about 90% of the total catch. There seems no consistent pattern between CPUE and regional catch by years. In 1997, the highest CPUE was in Kiribati region and the lowest in FSM region while the highest catch was in PNG waters and the lowest in Solomon Islands. In 1998, CPUE were similar in all areas while the highest catch was found in the high sea region. In 1999, high catch were found in both FSM and high sea areas while the highest CPUE was in the PNG waters. For 2000, the highest CPUE was found in the Solomon Islands, Kiribati and Tuvalu, while high catch were found in PNG, FSM and high seas. In 2001, the highest CPUE was found in PNG region and the lowest in Tuvalu region while the highest catch was located in Kiribati waters and the lowest in Tuvalu region.

In terms of “school types”, most of the catches in DWPS fishery were from “free” and “associated” schools (Figure 6(A)). This pattern is
consistent for all years between 1997 and 2001. The average CPUE for these two types were between 21 and 48 mt/set (Figure 6(B)). The highest CPUE although was found in “feeding school” in most years (except for 2001), this type of school was, in general, difficult to find, as a result, the percentage of fish caught in this school only accounted for a small percentage of the annual catch. The highest CPUE found in 2001 for “unspecified” school was from one record only.

**The fresh/chilled tuna longline fishery**

The CTLL vessel include those vessels operate in coastal and offshore waters of Taiwan and is in general, smaller than 100 GRT. However, in recent decades, the fishing pattern of this fleet has been changed. Some of the vessels are now operating not only in the coastal and offshore regions but also in distant waters (or EEZ of foreign countries) depending upon size and facilities equipped.

Number of registered CTLL vessels (<100 mt) was similar during 1997-2001 period, and estimated to be about 1700 (included vessels operated in both the Pacific and the Indian Oceans). Total catch of tuna and tuna-like species landed in Taiwan by this fleet was stable and averaged at about 47,000 mt during 1997-2001 period (Table 3). The dominant species caught included yellowfin tuna, bigeye tuna, swordfish, billfishes, and other tuna species (Figure 7).

In addition to catches landed at domestic ports, averaged catches of
bigeye and yellowfin tunas unloaded in the foreign base, ports of Pacific Ocean, were estimated to be about 5,361 and 6,541 mt, respectively during 1997-2001 period (Table 4).

With limited logbook recovered, it was found that the major fishing grounds of CTLL vessels based on domestic ports were located in area of 110-160°E/10-35°N, especially waters south and east of Taiwan and northeast of the Philippine Islands, and in areas around 131-138°E/14-20°N (Figure 8). Catches in the east of 150°E were very small. However, this figure may not be well represented due to low recovery of logbook in the fishery.

**Market destination of catches**

Most of the catches from FTLL vessels were landed at American Samoa and Fiji or transshipped to Thailand for canning. Similarly, catches of DWPS fishery were also transshipped to Thailand for canning, except for a very small percentage, which might be sold to Japan for Katsuobushi and sashimi. Fishes caught by CTLL vessels, however, were mostly sold in the local market or transshipped to Japan for sashimi market.

**The Vessel Monitoring System**

The experimental vessel monitoring system (VMS) was implemented continuously from previous year for the purpose of better management of
our distant water fishing vessels. The government has encouraged FTLL vessels to install the VMS through an incentive program since July 1996. Currently, more than 56 longline and essentially all purse seine vessels operating in the Pacific have installed such a system. It is our goal that all distant water vessels operating in the region will eventually be equipped with such a system.

The Observer Program

In addition to the vessel monitoring system, for purposes of improving quality of catch statistics and understanding bycatch related issues of our distant water fisheries, and in line with the international trend on management of highly migratory species, the government has launched an experimental observer program in 2001. Observations covered by this program include catch statistics, bycatch, discards, sharks, seabird, sea turtle, and marine mammals and some biological information, such as length and otolith,… etc. for major tuna species. In 2002, the program has expanded to include 6 observers in three major Oceans. It is expected that data obtained from this program will be used for better understanding of operation situation of our distant water fisheries operating in the region.

The Management Efforts Implemented by Government

In order to be in accordance with the international trend on management of marine resources, our government has initiated a program on management and/or conservation of some marine species, such as green
turtle (*Chelonia mydas*) and whale shark (*Rhincodon typus*). The satellite telemetry technique has been introduced to study the migration patterns of green turtle and whale shark. Also, a sanctuary area for green turtle was established in Pen-Hu Island (southwest of Taiwan) to protect their spawning and nursery ground.

In 2002, a shark conference was held in Taiwan to discuss the conservation and utilization of shark resources in the Ocean. A total allowable catch (TAC) of 80 individuals per year for whale shark also has been set on July 1 of 2002. In addition, two whale sharks have been tagged successfully on April 2002 to study their migration behavior. Current information indicated that whale shark migrate between south eastern Taiwan and Philippines, and mostly stayed in water columns where temperature were between 24°C and 28°C.

Except for the whale shark, stock assessment on certain shark species such as bigeye thresher shark (*Alopias superciliosus*) also was conducted.
Figure 1. Effort distribution of Taiwanese frozen tuna longline fleet operating in the Pacific Ocean during 1997-2000 period.
Table 1. Catch (in mt, round weight) statistics of major tuna and tuna-like species caught in frozen tuna longline fishery in the Pacific region during 1997-2001 period.

<table>
<thead>
<tr>
<th>Year</th>
<th>ALB</th>
<th>BET</th>
<th>YFT</th>
<th>SWO</th>
<th>BILL</th>
<th>SKJ</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>19,524</td>
<td>726</td>
<td>1,108</td>
<td>182</td>
<td>322</td>
<td>266</td>
<td>22,128</td>
</tr>
<tr>
<td>1998</td>
<td>18,416</td>
<td>1,395</td>
<td>904</td>
<td>228</td>
<td>585</td>
<td>499</td>
<td>22,027</td>
</tr>
<tr>
<td>1999</td>
<td>18,245</td>
<td>1,993</td>
<td>1,181</td>
<td>315</td>
<td>503</td>
<td>779</td>
<td>23,016</td>
</tr>
<tr>
<td>2000</td>
<td>20,981</td>
<td>2,876</td>
<td>2,105</td>
<td>362</td>
<td>1,415</td>
<td>274</td>
<td>28,013</td>
</tr>
<tr>
<td>2001*</td>
<td>16,224</td>
<td>8,070</td>
<td>4,814</td>
<td>2,237</td>
<td>880</td>
<td>311</td>
<td>32,536</td>
</tr>
</tbody>
</table>

* a preliminary result

Fig. 2. Mean catch percentage of major tuna and tuna-like species caught by Taiwanese frozen tuna longline fishery in the Pacific region during 1997-2001 period.
Table 2. Catch (in mt, round weight) statistics of major tuna species caught in distant water purse seine fishery in the Pacific region during 1997-2001 period.

<table>
<thead>
<tr>
<th>Species</th>
<th>Year 1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKJ</td>
<td>116,073</td>
<td>193,728</td>
<td>160,453</td>
<td>194,499</td>
<td>182,531</td>
</tr>
<tr>
<td>YFT</td>
<td>50,722</td>
<td>64,764</td>
<td>41,905</td>
<td>38,579</td>
<td>45,853</td>
</tr>
<tr>
<td>BET</td>
<td>401</td>
<td>201</td>
<td>3,372</td>
<td>1,900</td>
<td>2,284</td>
</tr>
<tr>
<td>Total</td>
<td>167,196</td>
<td>258,693</td>
<td>205,730</td>
<td>234,978</td>
<td>230,668</td>
</tr>
</tbody>
</table>

* a preliminary result
(Note: catch of bigeye in 1997 and 1998 has not been adjusted)

Fig. 3. Mean catch percentage of major tuna and tuna-like species caught by Taiwanese distant water purse seine fishery in the Pacific region during 1997-2001 period.
Figure 4. Effort distribution of Taiwanese distant water purse seine fleet operating in the Pacific Ocean in 1998, 1999, 2000, and 2001.
Fig 5. Comparison of (A) CPUE (mt/set) and (B) annual catch percentage among fishing area in Taiwanese distant water purse seine fishery operating in the Pacific region during 1997-2001 period. (1) Federated States of Micronesia (FSM); (2) High seas; (3) Indonesia; (4) Papua New Guinea (PNG); (5) Solomon Islands; (6) Kiribati; (7) Marshall Islands; (8) Nauru; (9) Tuvalu
Fig. 6. Comparison of (A) annual catch percentage and (B) CPUE (mt/set) by school types in Taiwanese distant water purse seine fishery operating in the Pacific region during 1997-2001 period. (1) free school; (2) associated school (including FADs); (3) feeding on bait fish school; (4) life-whale-shark school; (5) others (unspecified).
Table 3. Catch (in mt, round weight) of tuna and tuna-like species in the fresh/chilled tuna longline fishery landed in domestic ports of Taiwan (including vessels operated in distant waters) during 1997-2001 period.

<table>
<thead>
<tr>
<th>Year</th>
<th>Species</th>
<th>ALB</th>
<th>BET</th>
<th>YFT</th>
<th>SWO</th>
<th>BILL</th>
<th>SKJ</th>
<th>TUN</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td></td>
<td>973</td>
<td>3,772</td>
<td>9,994</td>
<td>2,604</td>
<td>16,771</td>
<td>3,494</td>
<td>8,576</td>
<td>46,183</td>
</tr>
<tr>
<td>1998</td>
<td></td>
<td>613</td>
<td>3,669</td>
<td>9,456</td>
<td>2,450</td>
<td>16,524</td>
<td>2,991</td>
<td>10,683</td>
<td>46,385</td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td>382</td>
<td>2,673</td>
<td>10,347</td>
<td>2,720</td>
<td>14,486</td>
<td>2,663</td>
<td>14,355</td>
<td>47,626</td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td>944</td>
<td>2,092</td>
<td>8,376</td>
<td>3,147</td>
<td>16,456</td>
<td>4,046</td>
<td>11,326</td>
<td>46,387</td>
</tr>
<tr>
<td>2001*</td>
<td></td>
<td>832</td>
<td>3,292</td>
<td>14,080</td>
<td>3,147</td>
<td>15,892</td>
<td>4,648</td>
<td>7,631</td>
<td>50,069</td>
</tr>
</tbody>
</table>

TUN: other tuna and tuna-like species.
* a preliminary result

Fig. 7. Mean catch percentage of major tuna and tuna-like species caught by Taiwanese fresh/chilled tuna longline fishery in the Pacific region during 1997-2001 period.
Table 4. Estimated catch (in mt, round weight) of yellowfin tuna and bigeye tuna in Taiwanese offshore longline fishery based on foreign ports in the Pacific region during 1997-2001 period.

<table>
<thead>
<tr>
<th>Species\Year</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001*</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>BET</td>
<td>5,862</td>
<td>5,035</td>
<td>5,467</td>
<td>4,441</td>
<td>6,001</td>
<td>5,361</td>
</tr>
<tr>
<td>YFT</td>
<td>7,032</td>
<td>4,948</td>
<td>6,578</td>
<td>7,042</td>
<td>7,106</td>
<td>6,541</td>
</tr>
<tr>
<td>Sum</td>
<td>12,893</td>
<td>9,983</td>
<td>12,045</td>
<td>11,484</td>
<td>13,107</td>
<td>11,902</td>
</tr>
</tbody>
</table>

* a preliminary result

Figure 8. Effort distribution of domestic longline fleet operated in the Pacific Ocean during 1998-2001 period. A, B and C represent for high, medium and low effort area, respectively.