

## FROM LOCAL TO GLOBAL: A CATCH RECONSTRUCTION OF TAIWAN'S FISHERIES FROM 1950-2007<sup>1</sup>

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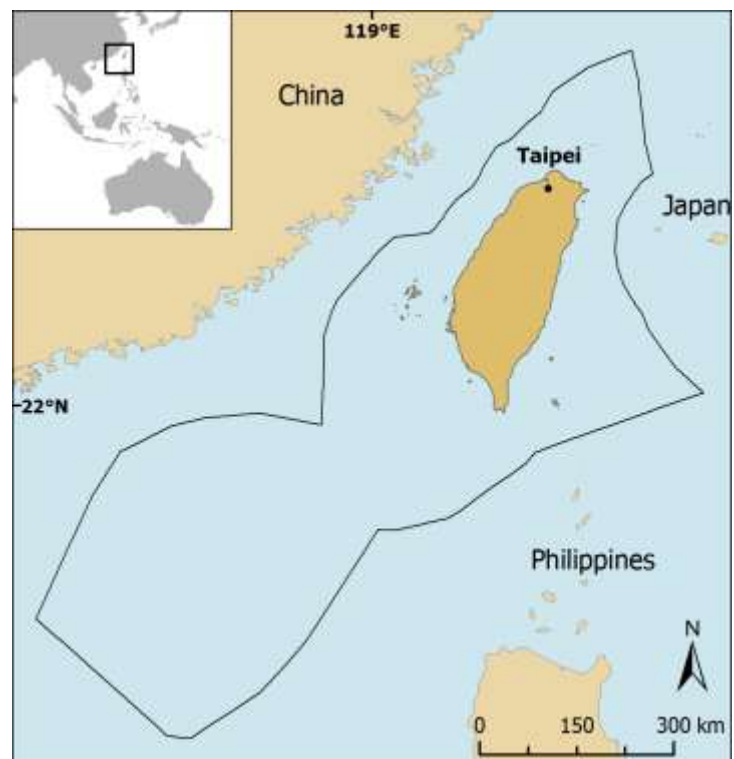
### ABSTRACT

Taiwan's coastal fisheries were considered overfished in the 1950s, and, as a result, Taiwan expanded its fisheries into offshore areas and to distant-waters beginning in 1959. Taiwan's fisheries catches within its own EEZ increased until 1980, and total catches were estimated to grow from approximately 95,000 tonnes in 1950 to 575,000 tonnes in 1980. However, since 1980, total catches taken by Taiwan within its own EEZ have been in decline and were estimated to be only 290,000 tonnes in 2007. Although the catches taken within the EEZ have been in decline, the distant-water fisheries (DWF) have expanded into all major oceans. By the 2000s, they were 3 to 5 times larger than those from its own EEZ. Total catches of the distant-water fleet were estimated to increase from 110,000 tonnes in 1959 to 1.5 million tonnes in 2007. However, the continued expansion of the DWF is not likely sustainable due to the increased pressure on fisheries stocks globally, and because of the large amount of fuel subsidies the DWF receives.

### INTRODUCTION

Taiwan ("Republic of China") is an island country located off the southeast coast of the People's Republic of China in the South China Sea (Figure 1). The west coast of Taiwan is separated from China by the relatively shallow Taiwan Strait and its east coast lies along the much deeper Philippines Sea. Taiwan has always relied on the sea for resources, and its fisheries are well developed and provide an essential source of food and income for its people.

The population of Taiwan grew from approximately 7.5 million people in 1950 to approximately 23 million people in 2007 (Anon., 2009). The increasing population, and its seafood demand, the decline of near-shore resources, and the high level of pollution of inshore areas, have resulted in Taiwan's fisheries expanding into offshore waters and eventually to distant waters. Taiwan's diplomatic isolation has often caused problems during negotiations with neighbouring countries resulting in territorial disputes. Consequently, Taiwan's exclusive economic zone (EEZ) is highly disputed and frequently challenged (Figure 1; Chen, 2007).



**Figure 1.** Map of Taiwan and the exclusive economic zone (EEZ) it claims.

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It is widely suspected that Taiwan, like a number of other countries, tolerates extensive Illegal, Unreported and Unregulated (IUU) fisheries, and thus the annual catches reported to the Food and Agriculture Organization (FAO) are minimum estimates that may omit significant catches. This report aims to provide a more accurate estimate of Taiwan's annual fisheries catches from 1950–2007 by including estimates of unreported catches and discards. Some catches, which contribute to the local or global supply of seafood, are often unreported for tax avoidance purposes, and are usually not included in assessments or quota considerations, which undermine fisheries management policies. Discards increase economic benefits for fishers by increasing profits, and are a form of fishing mortality that may not be accounted for, and therefore may lead to detrimental effects on exploited fish populations.

### *EEZ fisheries*

Taiwan's fisheries have traditionally been considered as two distinct fisheries—the coastal and the “distant-water fisheries”. The coastal fisheries operate up to the 12 nm territorial sea boundary, whereas the distant-water fisheries operated past the 12 nm demarcation of the coastal fisheries. However, Taiwan's definition of ‘distant-water’ changed with the expansion of the fisheries into all of the major oceans beginning in 1959, using gears such as trawl, longline, and purse seine. Thus, the distant-water fisheries were re-categorized as those operating in the far seas, and the fisheries around the waters of Taiwan were re-defined as ‘coastal’ and ‘offshore’. Throughout this report we refer to the coastal and offshore fisheries as those operating in what is today considered to be within the Taiwanese exclusive economic zone (EEZ), and reserve the term distant-water fleet (DWF) for those fisheries operating outside the EEZ.

As an island country, Taiwan has extensively developed its fisheries for food security, but it has also used its fisheries to gain political influences. After World War II, Taiwan was faced with a growing population, food shortages, and a heavily damaged fishing industry (Huang and Chuang, 2010). During that time, Taiwan's inshore fishing grounds were already considered to be overfished, and in order to meet domestic demand, Taiwan began to expand its fisheries into distant waters because of the declining fisheries resources within its local waters (Chen, 2007).

### *Distant water fisheries*

The growth of the post-war Taiwanese distant-water fishery after WWII was dictated by urgent economical and political needs. During the post-war period, there was a push towards an “Every Fisher Has His Boat” policy. As part of this policy, the government offered subsidies to encourage the purchase of fishing boats and to stimulate the launching of more boats (Chang *et al.*, 2010). The government also attracted investors for the DWF with the support of the United States Agency for International Development (USAID) and the World Bank during 1953 – 1973 (Chang *et al.*, 2010). Beginning in 1961, investments were directed towards Taiwan's DWF to support the production of large-scale longliners and trawlers (Chang *et al.*, 2010). At the same time, the construction of small trawlers was suspended in 1967 because of the drastic increase of fishing boats in the coastal region and depletion of coastal fisheries resources.

During the mid-1970s to early 1980s, the DWF was affected by two international oil crises, which increased the costs of operation and resulted in decreased landings in some years (Chang *et al.*, 2010). Also, many coastal nations declared EEZs starting in the late 1970s or early 1980s, and Taiwan's offshore fleets were prevented access to former areas of operation (Chen, 2007). Consequently, Taiwan began to focus on further expansions of the DWF resulting in an increase in landings from this fleet, while at the same time there was a decrease in landings from the offshore area of the Taiwanese EEZ.

From the mid-1980s to 1990s, the Taiwanese government continued to push for the growth of the DWF (Chang *et al.*, 2010). In 1983, a policy was implemented to suspend the building of all small-scale fishing vessels (< 1000 GRT) in order to develop the large-scale distant-water vessels (Chang *et al.*, 2010), i.e., high seas capable vessels. Beginning in the 1980s, the Taiwanese DWF also explored new gear types such as the squid drift net and tuna purse seine. The main fishery gear types consisted of tuna long line, purse seine, squid jig, saury stick held dip net, trawl, and large-scale tuna drift net fisheries (Chang *et al.*, 2010). The main species targeted during this time were yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*), albacore (*Thunnus alalunga*), skipjack (*Katsuwonus pelamis*), and argentine squid

(*Illex argentinus*) (Chang *et al.*, 2010). The massive deployment of drift nets, however, was short-lived as drift net fishing was banned by the UN in 1992 (Chen, 2007).

From the mid-2000s to the present, due to increasing problems of IUU fishing and vessels operating under flags of convenience, the Taiwanese longline fishery was sanctioned by the International Commission for the Conservation of Atlantic Tunas (ICCAT) in 2005. This was devastating to the Taiwanese distant-water fisheries, since longline vessels targeting bigeye tuna had their quota substantially reduced and Taiwan also lost its Cooperating Status in ICCAT. The sanctions imposed by ICCAT can, however, also be seen as an opportunity for Taiwan to reform its fisheries policies (Chang *et al.*, 2010).

### *Discards*

Discarding is a common practice within the fishing industry, and unwanted fish that have been caught are simply thrown back to sea. Discards can include damaged fish, non-target species, spoiled fish, and undamaged target species that are discarded to make room for more valuable ones (i.e., ‘high grading’). Much of the global discards currently are influenced by economic incentives, especially in DWFs. Depending on the markets of the fishing country, catches may be fully retained or largely discarded. For Taiwan, only a rough estimate of discards is possible, as neither the FAO nor the Taiwanese Fisheries Agency (FA) documents discards.

## MATERIALS AND METHODS

FAO reports, on behalf of Taiwan, annual landings statistics through their fisheries capture database (Fishstat) since 1950. Internally, Taiwan has two sets of data relating to fisheries. National landing statistics by area and gear are available from 1959 to 2007 through Taiwan’s Fisheries Agency (FA; [www.fa.gov.tw](http://www.fa.gov.tw)) and a separate set of statistics are available from the Taiwanese Council of Agriculture, Executive Yuan that describe the food balance for the country from 1984 to 2007 ([www.ttdais.gov.tw/view.php?catid=20242](http://www.ttdais.gov.tw/view.php?catid=20242)). The food balance statistics include the human population, domestic production for fish and seafood, imports, exports, and domestic supply, and are expressed in live weight equivalents. The sub-categories under the domestic production for fish and seafood include ‘fish’, ‘shrimps and crabs’, cephalopods, ‘shell fish’, ‘others’, and ‘dried (salted) fish’.

A comparison between the national landings and FAO landings was conducted to determine the quality of data transfer from the Fisheries Agency (FA) to FAO. Freshwater fishes, corals, marine mammals, and seaweeds were removed from FAO landing statistics for the purpose of this comparison. Similarly, we excluded the freshwater fisheries and all aquaculture statistics from the FA national landings. The data from FA were also compared to the food balance data for the period 1984 – 2007 when published statistics are available.

The domestic production from the food balance data was converted into estimates of annual national catches by the following formula:

$$\text{Catch} = \text{Domestic Production} + \text{Export} - \text{Import} - \text{Marine Culture} - \text{Freshwater Culture} - \text{Inland Catch} \quad \dots(1)$$

The marine culture, freshwater culture, and inland catch statistics were taken from the FA’s national landing statistics. The annual catch determined from equation (1) was compared to the annual FAO and FA total landings to check for inter-agency discrepancies.

### *Unreported catches*

We assume that discrepancies found between the food balance data and that supplied to the FAO via the FA represent unreported catches. For the years 1954–1983, when there are no data available from the FA, we use the average rate of unreported catches (~33%) reported from 1951 to 1953 (Sung, 1972) to estimate unreported catches. We further assume that the unreported catches are proportional to the spatially reported landings. Unreported catch rates were applied to the reported landings from the coastal, offshore and distant water fisheries. The unreported catches for each FAO area are distributed in proportion to the reported taxa, except in FAO area 61 and 71. For FAO 61, the “sharks, rays, skate, etc, nei” category were

distributed in proportion to the species reported in Lawson (1997). The unreported catch rates for FAO area 71 were applied in proportion to the species reported for the Taiwanese distant water longline catch (Lawson, 1997).

## Discards

The discard portion of the Taiwanese catch reconstruction is based on estimates, since no official records of Taiwanese discards exist. Discard rates were applied to the sum of the reported and unreported landings. Longline discard rates were based on data presented in Kelleher (2005; Table 1). The average rates of longline discards calculated from this publication were applied according to their reported areas and year. The discard rate of purse seine, trawl, squid jig, and nets are rates provided for other countries operating in the same area (Kelleher, 2005). We used reported discards by gear and target species as a proportion of retained catches by gear and target species to derive discard rates. We applied these derived discard rates to the sum of the reported and unreported landings to estimate discard amounts.

**Table 1.** Summary table of discard rates used for the various oceans and gear types of the Taiwan fisheries fleets.

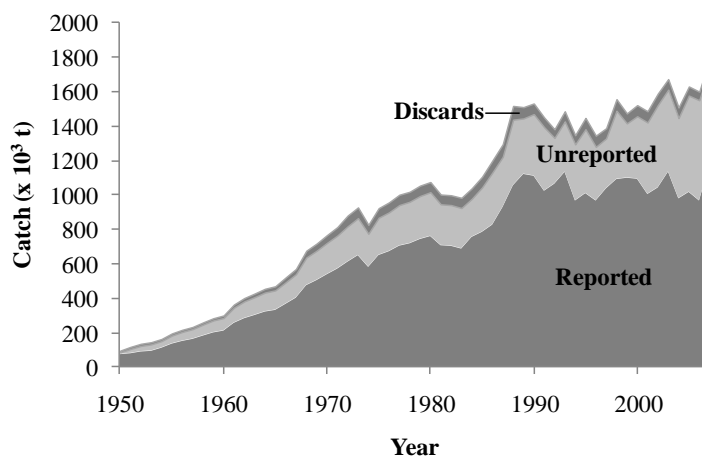
Year	Ocean	Gear	Discard rate	Source
1950-1997	Pacific	longline	0.113	Mejuto <i>et al.</i> (1997)
1998-2007	Pacific	longline	0.124	Mejuto <i>et al.</i> (1997) and Kelleher (2005)
1950-1994	Atlantic	longline	0.160	Cramer 1998 and Mejuto <i>et al.</i> (1997)
1995-2004	Atlantic	longline	0.400	Kelleher (2005)
2005-2007	Atlantic	longline	0.130	Mejuto <i>et al.</i> (1997)
1950-1989	Indian	longline	0.340	½ the 1990-1999 rate
1990-1999	Indian	longline	0.680	Mejuto <i>et al.</i> (1997)
2000-2004	Indian	longline	0.460	Mejuto <i>et al.</i> (1997)
2005-2007	Indian	longline	0.390	Mejuto <i>et al.</i> (1997)
1950-2007	all	purse seine	0.040	Amande <i>et al.</i> (2008) and Anon. (2003)
1950-2007	all	shrimp trawl	0.970	Clucas (1997)
1950-2007	all	demersal trawl	0.123	Kelleher (2005)
1950-2007	all	squid jig	0.500	Kelleher (2005)
1950-2007	all	other nets	0.014	Kelleher (2005)

The discard rates thus derived were applied spatially to each major fishery based on gear type. The longline and purse seine discards were assigned to both the EEZ and distant water fisheries. Discards associated with squid jigging in the Pacific and net discards (excluding purse seines), which are almost exclusively used in coastal and offshore areas, were assigned to EEZ fisheries only. The longline and purse seine fisheries within the EEZ had discard rates applied in proportion to the reported landings by the two gear types using the FA's national statistics. For the DWF, the longline and purse seine discards were also assigned proportionally, based on reported landings by the two gear types. Discards from the trawl fishery and the squid fisheries in oceans other than the Pacific were assigned to the DWF.

An additional 279 t·year<sup>-1</sup> of whale shark catches are applied from 1990 to 2000, and 126 t·year<sup>-1</sup> applied from 2001 to 2007 to the offshore catches due to the unregulated nature of the whale shark fisheries (Chen *et al.*, 1997; Chen and Phipps, 2002). Whale sharks are usually sold outside of the market system to avoid fees, and only two markets have recorded landings statistics for whale sharks (Chen *et al.*, 1997).

## RESULTS

The total reconstructed catches amount to 54.7 million tonnes from 1950-2007, as



**Figure 2.** Total reconstructed catches including reported landings, unreported catches and discards.

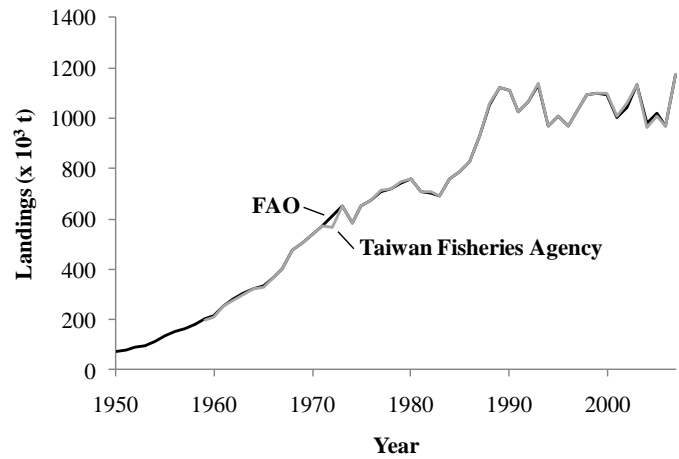
compared to the landings reported to FAO of approximately 38.2 million tonnes. The difference of 16.5 million tonnes is estimates of IUU in the form of unreported catches and discards. Unreported catches are the dominant form of IUU accounting for 84% of the IUU catches assessed here (Figure 2).

*Total unreported catches*

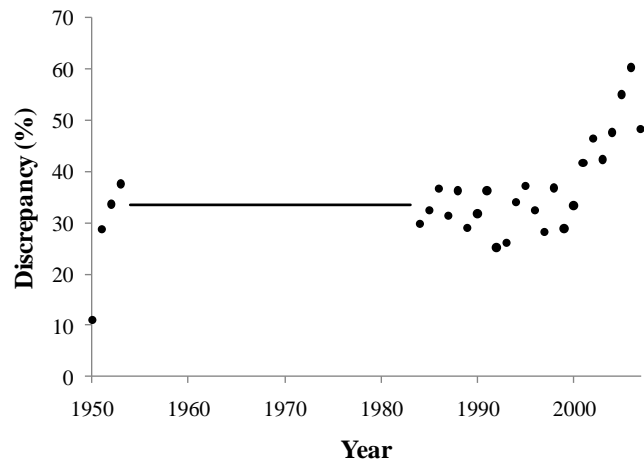
The FAO landings statistics and the FA national landings statistics are largely indistinguishable (Figure 3), indicating that the data transfer between FA and the FAO was efficient. However, discrepancies in landings were found between 1950 and 1953, and from 1984 onwards using alternative sources. Catches for Taiwan from 1950 – 1953 were, on average, about 28% higher than the national FA statistics (Sung, 1972) and the discrepancies increased from approximately 11% in 1950 to 38% in 1953. Discrepancies between the food balance data and the FA data for the later time period (1984-2007) averaged 37%, and also showed an increasing trend through time (Figure 4). Over the entire period (1950-2007), unreported catches estimated from the discrepancies between the food balance data and the FA amount to 13.6 million tonnes. Although the yearly discrepancies were relatively small during the first 4 years (1950 -1953 average: ~25,000 t·year<sup>-1</sup>), after 1983, these differences increased over time and range from 225,000 t·year<sup>-1</sup> to 567,000 t·year<sup>-1</sup>.

*Total discards*

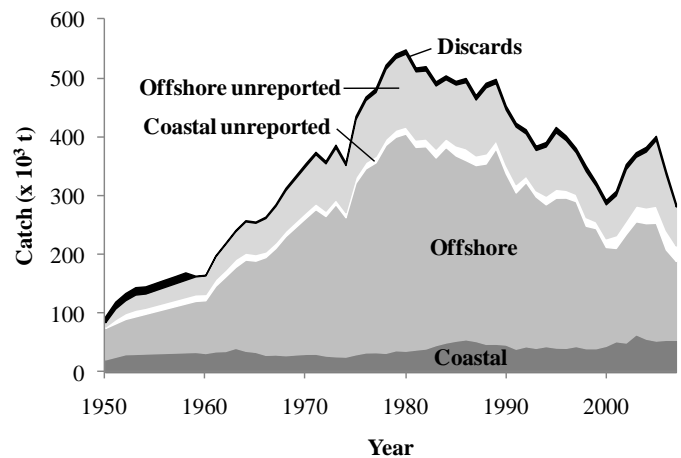
Our estimated total discard amounts were fairly constant from 1950 to 1959 and averaged 12,000 t·year<sup>-1</sup>. However, with the expansion of the DWFs, discards increased and peaked at 80,000 tonnes in 1988, representing 5% of the total reconstructed catch. Total discards declined to approximately 47,000 tonnes in 2007 and represent 3% of the total reconstructed catches. From 1959 onwards, the average discard rate applied to reported landings and unreported catches was 5.3%. We estimate that between 1959 and 2007, the highest rate of 8% occurred in 1972, but has since dropped to 3% in 2007.



**Figure 3.** National statistics as reported by FAO and by the Fisheries Agency of Taiwan.



**Figure 4.** Discrepancies (%) between the food balance data and reported landings. Dots are reported values and the solid line indicates an estimated value (mean of 1951-1953).

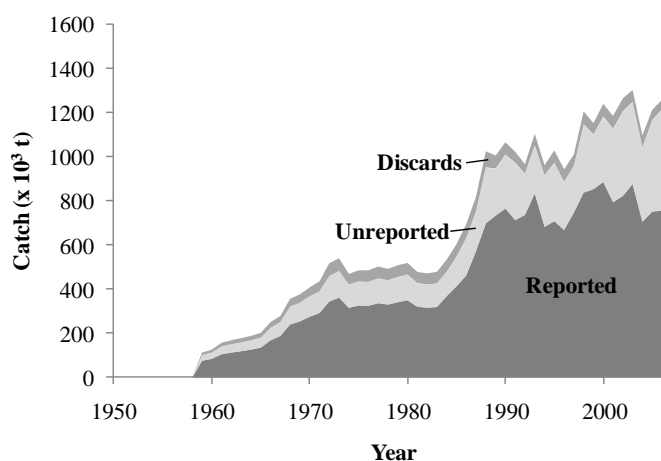


**Figure 5.** Catches taken within the EEZ waters of Taiwan, including coastal (with catches considered here to be taken by the small-scale sector) and offshore fisheries, unreported catches and discards.

## EEZ fisheries

Fisheries in the EEZ of Taiwan, which consist of the coastal and offshore sectors, increased from the 1950s until the 1970s by approximately 100,000 t-decade<sup>-1</sup> (Figure 5). Reported landings increased from 75,000 t-year<sup>-1</sup> in 1950 to 401,000 t-year<sup>-1</sup> in 1979. Annual catches within the EEZ peaked in 1980 at 407,000 t-year<sup>-1</sup>, but have steadily declined and were only 190,000 t-year<sup>-1</sup> in 2007. The declines in landings from the EEZ waters have occurred in the offshore waters. Coastal fisheries, relying mostly on fixed nets, have been subject to overfishing since the 1950s (Chen, 2007) and apparently may also have been affected by the expansion of aquaculture. Coastal fisheries, roughly corresponding to small-scale fisheries, averaged reported landings of approximately 31,000 t-year<sup>-1</sup> between 1950 and 1979, and increased to average 47,000 t-year<sup>-1</sup> between 1980 and 2007 (Figure 5). Offshore reported landings increased from 55,000 tonnes in 1950, peaked in 1980 at about 370,000 tonnes, but have since declined to 135,000 tonnes in 2007 (Figure 5).

From 1950 to 2007, unreported catches within the EEZ were estimated to be over 5 million tonnes (Figure 5). Unreported catches increased from 8,400 tonnes in 1950, peaked at about 136,000 tonnes in 1980, and declined to 92,000 tonnes in 2007. Discards within the EEZ were estimated to be highest in the first decade due to the amount of trawling. Trawl landings declined from 89% to 33% of reported landings between 1950 and 1959, but due to the increased landings trawl discards were estimated to average 12,000 t-year<sup>-1</sup> between 1950 and 1958. With the expansion of fleets into distant waters beginning in 1959, we estimate that the discards within the EEZ waters declined, but those from DWF began to increase. Discards were estimated to average approximately 21,000 t-year<sup>-1</sup> from 1959-2007, but increased from 7,600 tonnes in 1959, peaked during the 1980s at 33,000 t-year<sup>-1</sup> before declining to 8,000 t-year<sup>-1</sup> in 2007 (Figure 5).



**Figure 6.** Total reconstructed catches for the DWF, including reported landings, unreported catches and discards.

## Distant water fisheries

In more recent times, distant-water fisheries represent the most significant component of Taiwanese fisheries. The DWF accounts for approximately 62% of the total reported Taiwanese landings from 1950 to 2007, and mainly targets tunas and squids using longline, purse seine and jig. Since 1985, the DWF have consistently been the largest contributor to Taiwan's reported total landings. With decreased access to other neighbouring countries waters starting in the late-1970s due to the increasing declaration of EEZs, the DWF was rapidly developed in the 1980s, and reported landings from these fisheries during the 2000s are now 3 to 5 times larger than those from the EEZ in terms of annual reported landings (Figure 6).

Unreported catches from the DWF were estimated to contribute over 8.7 million tonnes to the total catches from 1959-2007 (Figure 6). Unreported catches increased from 26,000 tonnes in 1959 to 97,000 tonnes in 1971. Between 1972 and 1987, unreported catches were between 100,000 and 200,000 tonnes, and averaged 120,000 t-year<sup>-1</sup>. Unreported catches have increased from 253,000 tonnes in 1988 to 477,000 tonnes in 2007. Discards from the DWF were estimated to have increased from 5,000 tonnes in 1959, peaked at 53,000 tonnes in 2002, but have since declined to approximately 39,000 tonnes in 2007.

## DISCUSSION

From 1950-2007, the total reported landings were over 38 million tonnes. Reported landings increased from about 75,000 tonnes in 1950 to over 900,000 tonnes in 1987. Since 1988, annual reported landings have been approximately 1 million t-year<sup>-1</sup>. Unreported catches from 1950-2007 were 13.7 million tonnes,

and increased from about 8,000 tonnes in 1950 to 568,000 tonnes in 2007. Discards rose from 10,000 tonnes in 1950 to 80,000 tonnes in 1988 and then began to decline, amounting to approximately 47,000 tonnes in 2007. As estimated here, our total reconstructed catches including reported landings, unreported catches and discards amount to 54.7 million tonnes and are 43% larger than reported landings. This estimation is probably conservative. While the unregulated portion of IUU catches in Taiwan may be small, the unreported illegal portion may be large, leaving out a potentially significant portion of IUU catches.

The unreported catches that we estimated, based on the food balance data, may represent unreported by-catch from the EEZ fisheries and DWF. With the exception of FAO fisheries statistical area 61, the only species reported from other fisheries statistical areas were tunas, marlins, squids, unidentified sharks, and unidentified marine fishes (“marine fishes nei”). The “marine fishes nei” category accounts for a small proportion of the overall catch statistics in FAO, and thus would be an underestimate because it doesn’t account for all bycatch. It was not until 1991 that the government enforced an observer and vessel monitoring program to track fisheries catches (Chang *et al.*, 2010). However, the fact that most of the reported DWF landings are high-value target species (e.g., tunas) makes it possible that the estimates of unreported catches reported here are mainly comprised of bycatch species.

The expansion of Taiwan’s fishing fleet into offshore areas of the EEZ beginning in 1959 increased annual landings until many of Taiwan’s neighbours declared EEZs, increasingly limiting the fishing areas accessible by Taiwan. The loss in catches from traditional fishing grounds caused a fairly rapid expansion of the DWF in the early years, but has since slowed. As estimated here, the total reconstructed DWF catches doubled from 113,000 tonnes to 251,000 tonnes in 8 years (1959-1966), doubled again from 251,000 tonnes to 500,000 tonnes in 7 years (1966-1972), but it took 17 years for DWF catches to double from 500,000 to 1 million tonnes (1972-1988). Total reconstructed DWF catches were estimated to be 1.5 million tonnes in 2007.

Taiwan’s fisheries contribute to national food supply, and presently the DWF catches compensate for the declining catches from the Taiwanese EEZ. However, the DWFs are highly vulnerable to fluctuations in the energy sector in the form of rising fuel costs. Decreased catches were the result of the oil crisis in the 1970s and again in the 1980s. Fuel used by the DWF is subsidized by the Taiwanese government, and in the year 2000 the \$US 0.09·litre<sup>-1</sup> subsidy amounted to \$US 120 million (Sumaila *et al.*, 2008). With increased pressure on fisheries stocks worldwide, this strategy is not likely to be sustainable, and the Taiwan DWF may thus experience difficulties expanding, or even maintaining their present catch volumes.

## ACKNOWLEDGEMENTS

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## APPENDIX

**Appendix Table A1.** Total Taiwanese catches (t) including coastal, offshore and DWF catches, and estimates of unreported catches and discards.

Year	Coastal	Coastal unreported	Offshore	Offshore unreported	DWF	DWF unreported	Discards
1950	20,885	2,313	54,297	6,082	n/a	n/a	10,091
1951	25,291	7,293	58,146	16,768	n/a	n/a	11,743
1952	29,696	9,991	61,365	20,645	n/a	n/a	12,185
1953	30,250	11,372	65,194	24,509	n/a	n/a	12,547
1954	30,804	10,276	69,023	23,025	11,672	3,894	12,085
1955	31,358	10,460	72,852	24,302	31,319	10,447	12,164
1956	31,911	10,645	76,681	25,579	42,582	14,205	12,256
1957	32,465	10,830	80,509	26,856	50,364	16,801	12,277
1958	33,019	11,015	84,338	28,134	65,177	21,742	12,578
1959	33,573	11,199	88,167	29,411	79,232	26,430	12,594
1960	31,761	10,595	91,170	30,413	88,763	29,610	14,811
1961	34,525	11,517	112,927	37,670	109,044	36,375	17,981
1962	35,214	11,747	128,176	42,757	120,505	40,198	19,403
1963	40,489	13,506	139,081	46,395	123,024	41,039	20,981
1964	35,597	11,875	156,419	52,178	129,641	43,246	22,057
1965	33,688	11,238	156,566	52,228	141,784	47,297	23,757
1966	28,615	9,545	167,718	55,948	170,469	56,865	28,230
1967	29,158	9,727	182,628	60,921	190,468	63,537	30,319
1968	27,985	9,335	204,064	68,072	242,674	80,952	39,559
1969	29,254	9,759	218,211	72,791	256,394	85,528	41,646
1970	30,338	10,120	232,541	77,571	274,857	91,687	45,363
1971	30,515	10,179	247,429	82,538	291,983	97,400	49,168
1972	27,383	9,134	238,833	79,670	344,309	114,855	62,451
1973	26,130	8,716	260,298	86,831	360,695	120,321	62,519
1974	25,565	8,528	238,499	79,559	314,568	104,934	51,703
1975	29,540	9,854	293,259	97,826	323,170	107,803	55,819
1976	32,732	10,919	314,452	104,895	322,634	107,625	58,122
1977	33,079	11,035	324,379	108,207	343,927	114,728	60,116
1978	32,024	10,683	355,094	118,453	329,542	109,929	58,025
1979	36,380	12,136	364,708	121,660	340,642	113,632	60,494
1980	35,645	11,891	370,906	123,727	350,744	117,002	59,177
1981	37,615	12,548	346,203	115,487	321,833	107,358	56,717
1982	39,445	13,158	345,471	115,243	316,514	105,583	57,166
1983	45,257	15,097	320,495	106,911	320,621	106,953	59,447
1984	49,650	14,840	334,131	99,868	369,453	110,425	61,066
1985	52,817	17,175	316,417	102,890	413,608	134,494	62,358
1986	55,087	20,169	306,179	112,101	463,361	169,650	69,506
1987	52,255	16,425	300,649	94,500	574,942	180,716	73,149
1988	47,439	17,205	308,114	111,743	697,246	252,868	80,051
1989	47,594	13,784	333,799	96,676	736,582	213,331	65,891
1990	46,162	14,669	292,670	93,005	768,945	244,357	62,047
1991	39,031	14,170	267,224	97,011	715,513	259,755	56,332
1992	43,201	10,892	280,792	70,797	738,388	186,173	50,352
1993	40,540	10,573	258,880	67,520	833,041	217,269	59,005
1994	43,496	14,822	242,553	82,655	680,082	231,753	53,388
1995	41,033	15,238	256,560	95,165	712,034	264,423	65,588
1996	40,576	13,202	256,933	83,599	669,567	217,860	64,938
1997	43,609	12,306	247,854	69,944	746,183	210,573	59,152
1998	39,911	14,689	209,721	77,188	841,794	309,825	67,427
1999	39,911	11,527	205,645	59,394	853,599	246,535	57,921
2000	44,016	14,701	169,520	56,620	879,804	293,857	64,585
2001	51,869	21,669	159,989	66,839	792,751	331,188	65,149
2002	49,669	23,090	185,939	86,441	806,549	374,956	67,028
2003	63,739	26,983	193,482	81,908	875,200	370,506	61,342
2004	56,290	26,822	197,722	94,213	725,849	345,863	61,952
2005	52,956	29,166	201,700	111,087	762,390	419,989	52,969
2006	54,381	32,809	154,873	93,436	758,058	457,343	50,032
2007	54,280	26,206	135,440	65,389	984,431	476,622	46,619

**Appendix Table A2:** Total reconstructed catch (t) for Taiwan within its EEZ, 1950-2007. Others category includes 92 taxa plus miscellaneous marine fishes grouping.

Year	<i>Katsuwonus pelamis</i>	Elasmobranchii	Shrimps and prawns	<i>Scomber japonicus</i>	<i>Thunnus albacares</i>	<i>Trichiurus lepturus</i>	<i>Todarodes pacificus</i>	<i>Saurida tumbil</i>	Others
1950	0	7,793	2,105	3,340	5,567	1,113	0	1,113	62,736
1951	0	10,416	2,436	5,208	6,510	1,302	0	1,302	77,286
1952	0	12,071	3,180	6,706	6,706	2,280	0	2,012	88,117
1953	0	13,144	3,216	6,918	6,918	2,352	0	2,075	95,421
1954	0	11,700	2,178	5,611	6,327	2,388	0	2,746	102,320
1955	0	11,447	3,095	7,563	6,132	3,679	0	8,994	98,201
1956	0	12,696	3,088	9,164	5,250	2,196	3,628	8,973	99,974
1957	0	12,680	2,765	6,983	4,870	2,848	827	9,004	110,829
1958	596	12,524	2,685	6,645	4,856	4,430	1,022	6,390	117,518
1959	481	10,908	3,167	7,058	4,652	3,529	2,566	8,502	121,652
1960	384	10,740	2,960	6,450	4,454	4,377	1,920	10,827	121,975
1961	1,143	11,026	3,315	5,868	4,649	6,554	3,201	9,222	151,830
1962	2,140	12,449	4,111	5,502	5,273	10,011	6,572	10,240	161,813
1963	1,496	11,081	5,996	8,582	4,803	8,739	7,716	14,093	177,174
1964	1,267	11,697	6,665	12,752	5,069	12,118	7,366	10,772	188,571
1965	839	12,782	9,164	12,125	5,490	12,430	6,787	15,328	178,996
1966	659	14,354	9,982	9,883	5,888	11,567	8,126	17,204	184,566
1967	453	16,930	12,624	6,498	6,575	14,130	5,365	15,642	204,665
1968	526	21,978	13,748	14,266	8,737	12,765	4,430	15,993	217,913
1969	536	22,525	19,928	17,002	10,178	9,956	5,208	15,624	230,056
1970	292	23,229	17,167	21,940	7,123	11,862	6,047	15,661	248,356
1971	577	23,676	18,323	16,118	5,607	12,338	3,780	15,761	275,201
1972	536	21,116	19,034	11,629	3,266	21,570	6,315	13,442	258,758
1973	1,497	20,561	22,678	5,064	14,061	20,067	14,433	13,167	271,445
1974	1,048	24,982	23,286	2,052	5,581	14,292	8,524	11,706	261,290
1975	1,575	38,465	35,359	2,735	10,106	14,876	13,377	14,733	300,222
1976	1,382	37,171	34,538	3,214	10,357	15,324	16,901	16,760	328,348
1977	1,962	35,664	35,432	6,061	14,470	14,754	12,600	17,996	339,301
1978	3,514	32,624	44,258	4,086	18,880	17,380	12,694	13,863	370,604
1979	2,554	29,720	47,963	4,489	21,237	11,838	23,602	18,177	376,904
1980	2,546	36,983	45,550	5,084	18,631	20,109	20,908	15,771	378,404
1981	1,872	30,727	39,428	15,529	15,626	16,344	24,570	10,975	358,096
1982	2,850	34,832	41,449	13,284	14,742	19,904	21,433	12,107	354,451
1983	5,605	30,954	42,896	15,501	13,784	17,098	11,875	10,956	340,893
1984	5,818	31,454	47,243	19,633	13,244	15,283	48,670	9,067	309,820
1985	12,241	39,056	52,032	23,308	13,454	14,144	17,167	7,993	312,356
1986	12,658	32,378	54,105	25,953	12,573	17,810	11,134	9,230	320,257
1987	13,909	30,018	44,525	20,472	16,236	11,582	12,576	6,503	310,804
1988	16,988	22,493	32,489	19,220	13,743	17,519	13,021	7,666	344,190
1989	26,106	26,216	29,816	18,246	10,007	23,684	23,350	4,468	332,690
1990	38,661	32,716	17,966	17,916	13,211	10,666	18,313	3,449	296,688
1991	32,881	32,123	14,713	15,392	13,192	9,457	26,799	2,892	272,749
1992	39,795	30,159	13,361	23,137	35,331	9,651	5,985	3,749	248,810
1993	49,823	23,912	8,394	21,226	36,165	8,725	5,279	3,445	225,435
1994	65,505	18,864	9,647	32,767	28,406	11,524	6,514	2,639	213,181
1995	81,935	21,428	14,481	32,530	27,565	9,737	13,361	4,051	209,083
1996	91,178	19,680	14,788	33,567	22,632	7,366	11,894	4,085	195,601
1997	58,985	18,503	13,199	28,238	33,512	5,348	7,424	1,916	212,235
1998	76,961	15,523	8,075	18,270	34,680	4,109	17,916	1,568	171,551
1999	66,962	19,803	7,909	23,998	27,530	4,962	5,961	1,628	163,373
2000	68,207	17,884	5,373	13,573	25,092	3,446	3,239	1,712	151,955
2001	70,155	14,463	6,334	12,839	27,285	4,668	2,492	1,188	167,347
2002	86,254	16,422	6,128	19,855	24,292	4,766	2,395	864	192,380
2003	62,978	23,402	611	28,636	21,259	4,633	256	975	229,432
2004	84,513	21,604	7,308	38,264	14,237	5,490	0	1,230	209,543
2005	69,930	21,173	12,847	43,292	18,771	4,716	0	1,281	228,895
2006	72,955	21,676	6,576	30,974	16,678	5,168	0	1,024	186,121
2007	60,188	16,789	4,655	21,673	12,604	3,706	0	818	164,776