3. Worldwide commercial fisheries for striped marlin

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3.1 Introduction

Striped marlin are commercially caught throughout their distributional range, in both the Indian and Pacific Oceans. While taken as incidental catch by a number of different gear types, including purse seine and drifting gillnet, most of the global catch of this species can be attributed to incidental catches by longline fisheries targeting tuna. Furthermore, because this species is valued as sashimi in Japan, whose fleets have accounted for the majority of reported striped marlin catches, there has been a tendency in some seasons/years and high catch regions to configure longline gear to deliberately target this species. As will be outlined in the following sections, Japanese, Korean and Taiwanese catch rates in both the Pacific and Indian Oceans have declined from those experienced in the 1960s. It is uncertain at this point whether the apparent decline in catch rates represents reduced abundance due to overfishing, or results from changes in fishing methods and targeting. Regardless, an increased international awareness of such trends, and of overfishing of other marlin species such as the white marlin in the Atlantic, as well as increased lobbying by recreational user groups, has brought this species under a much sharper and immediate management focus. Subsequently, there is increased need for scientific assessment of the species status at regional and global levels, to facilitate the determination of appropriate regulations. The following sections outline commercial catch and effort histories, on both a global, ocean-wide and regional scales. This overview acts as a lead in to Chapter 4 (Assessments) and assists as a comparison in a later review of local catch histories and management strategies (Chapters 5, 6 and 9).

3.2 Development of global fisheries

3.2.1 1950s and 1960s – Global expansion of longline fisheries

Most of the global catch of billfish (including striped marlin) is harvested by longlining, a method pioneered predominantly by the Japanese, Taiwanese and Koreans in the years following the end of World War II. Other nations have also taken significant catches of billfish in more recent times, but it was the post World-War II expansion of the Japanese longline fleets that resulted in the massive increase in the number of striped marlin (and of course tunas, the primary target of these fleets) being harvested from the Indian and Pacific Oceans. The eastward expansion of the Japanese fleet in the Pacific was rapid and by 1960, virtually all areas that are fished today in these oceans, had already been explored by Japan. This expansion, which covered the entire distributional range of billfish by the mid 1960s, coincided with the period at which catches of striped marlin were at their historically highest level (Ueyanagi et al. 1990). Originally these fleets were targeting predominantly albacore for canning, but as Taiwan and Korea started to target this species in the 1960s, Japan modernised its fishing technology and started to target species more highly valued as sashimi, particularly southern bluefin tuna in southern waters, as well as bigeye and yellowfin (Ward, 1996).

3.2.2 1970s and 1980s – Advent of EEZs

The average price for striped marlin increased dramatically (nearly 300%) between 1970 and 1985, due mainly to the advent of freezer technologies which allowed transport of marlin (and tunas) from distant waters, thus increasing demand for the species (Ward, 1996). This did not result in increased numbers of marlin being landed, possibly due to this period coinciding with establishment of exclusive economic zones and subsequent exclusion of distant water

fleets from many prime striped marlin catch grounds. Much of the global longline effort became concentrated in more tropical waters where striped marlin were less abundant, and the Japanese started setting their lines deeper to target adult bigeye. Such changes in gear, methods and fishing areas are thought to potentially explain part of the decline in striped marlin CPUEs that occurred in the late 1960s and 1970s. Certainly the change in fishing methods at this time complicates the interpretation of CPUE trends, and their use in stock status assessments must be employed very cautiously (Ueyanagi et al. 1990). Catch rates must be standardised for depth of hook setting and related changes in fishing methods.

In contrast to the Japanese fleet, the Taiwanese distant water fleets predominantly targeted albacore tuna. In the Pacific, effort (hooks) by this fleet increased throughout the 1970s from 35 millions hooks to over 130 million hooks by 1981. Effort then declined to 50 million hooks by 1986, before increasing again through to peak at over 150 million hooks in 2000. In the Indian Ocean, annual Taiwanese effort increased to over 300 million hooks in the 1990s. Much of the Pacific effort was concentrated in the central and western Pacific Ocean, while in the Indian Ocean effort has been concentrated in the tropical western region. The decline in striped marlin catches by this fleet over this period, may likely be closely connected to the decline in effort. The Taiwanese also had a smaller coastal fleet that could account for up to 750 tonnes of striped marlin annually during the 1980s. The Korean fleet has tended to target bigeye and yellowfin in the tropical and subtropical regions, and in the Pacific this fleet reported a marked decline in striped marlin catches from the mid 70s to the mid 80s (Ueyanagi et al. 1990).

Much of the tuna and marlin that were being caught by large distant water fleets were being taken in waters adjacent to other nations. However, fishing patterns of distant water fleets were forced to change progressively from the late 1970s when many nations declared 200 nautical mile exclusive economic zones (EEZs). Subsequently, many countries entered into access agreements with these distant water fishing nations or completely restricted access to fisheries resources within their waters. Australia, for example, progressively restricted access by Japanese longliners to its EEZ throughout the 1980s and mid 1990s, until their total exclusion from 1997 onwards (Ward, 1996). Consequently, access by distant water fleets to high catch regions for striped marlin, such as those off Hawaii, Mexico, New Zealand and Australia, declined considerably.

3.2.3 1990s and 2000+ - Recent trends

Striped marlin have historically constituted a significant fraction of the total global catch of billfish, behind swordfish and blue marlins. Furthermore, while the Japanese catch of striped marlin decreased from early levels, other nations such as the United States, New Zealand, Australia in the Pacific, and India, Seychelles and South Africa in the Indian Ocean, have developed domestic longline fisheries. While these target predominantly tuna and swordfish, they also have taken marlin as well. In some of these countries (e.g. NZ) the commercial landing of striped marlin is banned and the resource allocated solely to the recreational fishermen. However, in other countries such as Australia, this species is being taken in significant numbers by commercial boats. Other countries in Asia and South America have also developed longlining fisheries, but the level of "identified" catch is very low. Subsequently, the reporting of "unidentified billfish" species has increased dramatically, but the proportion of these catches which constitute striped marlin is unknown.

3.2.4 Current problems with catch data analyses and interpretation

The following sections detail catch and effort histories for striped marlin taken in the Indian and Pacific Oceans. It should be noted that while data collections systems are improving, analyses of catch and effort trends for billfish have been and are severely hampered by availability of catch and effort data and the quality of the data that is available. Data quality is

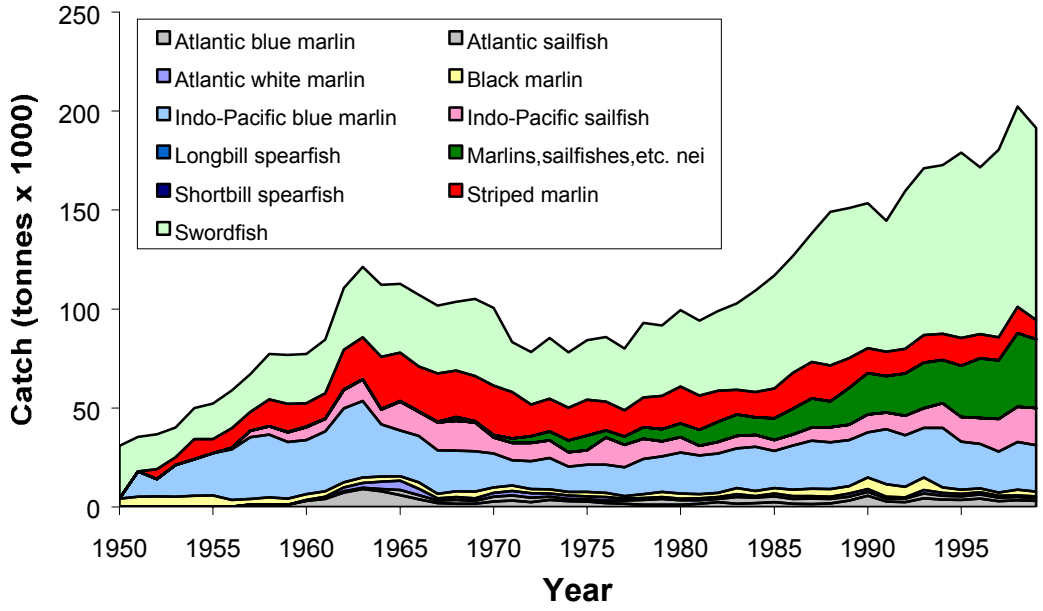

Figure 3.1- Global catches (cumulative) of different billfish species for the period 1950-1999 (Source: FAO 2002)

affected by completeness and issues associated with misidentification and non-reporting. Accurate size and weight data are not available for most of the fisheries.

3.3 Global catch and effort overview

3.3.1 Global billfish catch

The global catch of billfishes rose steadily from the early 1950s to peak at 121 000 tonnes in 1963, but then declined over the following decade (Figure 3.1). However, from the mid-1970s, billfish catches again increased and have continued to do so through to recent years (e.g., the 1998 global catch was 202 000 mt). The mid-1960s peak was largely due to increasing catches of blue marlin, striped marlin and swordfish. However, catches of blue marlin species subsequently declined, as did striped marlin catches (though at a less rapid rate). The increase in global billfish catch throughout the 1980s and 1990s can be largely attributable to rapidly increasing catches of swordfish, as well as increased reporting of "unidentified" billfish.

3.3.2 Striped marlin catches by ocean

Striped marlin are caught in the Indian and Pacific Oceans. The FAO has subdivided these regions for statistical purposes, with the Indian Ocean consisting of East and Western regions, and the Pacific Ocean also divided into 5 sub-regions (Figure 3.2). The decline in global catches of striped marlin can be mostly attributed to declining catches in the Pacific Ocean regions. Indian ocean catches have fluctuated but at a much lower level compared to that in the Pacific. In the 1950s and 1960s, the central eastern Pacific region accounted for the majority of striped marlin caught globally (Figure 3.3a). However large catches then started to be taken in the Pacific Northwest, and moderate catches started to be recorded in most other ocean regions in the Pacific and Indian Oceans. Furthermore, the massive catches recorded in

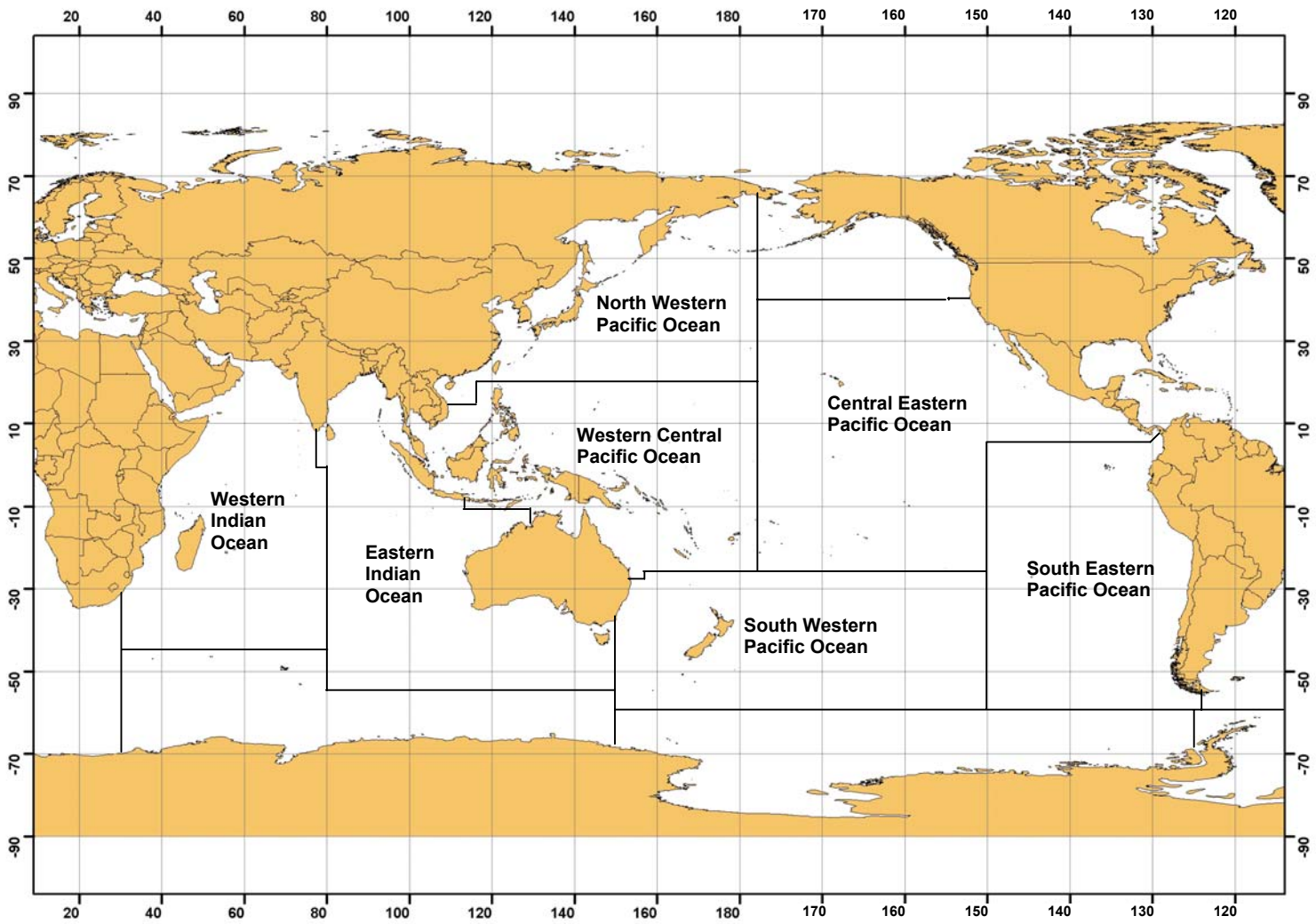

Figure 3.2 – FAO Fisheries statistical catch regions of the Indian Ocean and the Pacific Ocean (Source: FAO 2002)

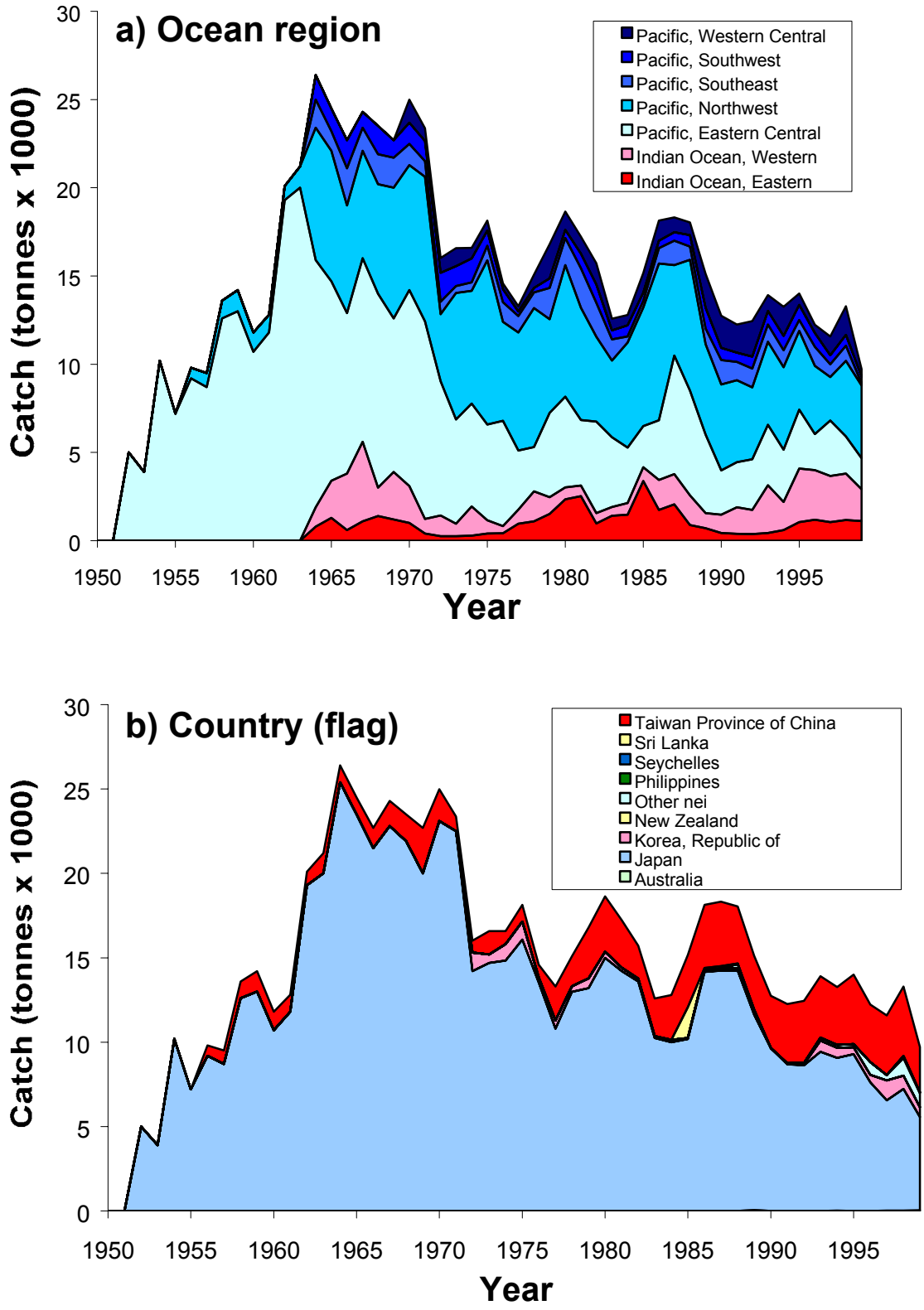

Figure 3.3 - Global catches (cumulative) of striped marlin by a) ocean region, and; b) country, during the period 1950-1999 (Source: FAO, 2002).

the eastern central Pacific in the 1950s and 60s have since been in a relatively continual decline.

3.3.3 Striped marlin catches by country

Global catches of striped marlin can be predominantly attributed to Japanese longliners operating in the Pacific and Indian Oceans over the past 40 years (Figure 3.3b). The declining in total global catches since the mid 1960s results predominantly from a decline in Japanese catches over this period. In contrast, Taiwanese catches increased since the mid-1960s and only recently have shown some signs of a decline. The Republic of Korea has also accounted for significant catches of striped marlin at various times during this period.

However, the following section looks in detail at the global catch and effort data as reported by the Japanese fleet since 1970. This analysis is useful for the fact that, in comparison to other distant water fleets, the Japanese have the most consistent and standardised methods for catching tuna, the best reporting record, and have reported far more striped marlin caught than any other nation. Subsequently, the Japanese dataset is the most reliable for the purposes of interpreting global catch rate trends. However, catch histories of other nations are also discussed in the subsequent sections that detail fisheries within the Indian and Pacific Oceans.

3.3.4 Global trends in Japanese longline catch, effort and catch rates

Introduction: The Japanese longline fleet is among the largest of any nation, has operated for the longest period, and over the widest area of the worlds oceans. Catch and effort data for this fleet has been obtained and is presented in the following pages as a series of global maps. Figures 3.4 to 3.6 describe mean annual catch, effort and catch rates as reported by this fleet over the past 32 years. Figures 3.7a to 3.7d describe mean quarterly catch rates of striped marlin, to demonstrate within year spatial movements of high catch zones. These figures help to illustrate spatial and temporal trends in catch rates for striped marlin on a global scale.

Mean annual Japanese longline effort: In the Indian Ocean, Japanese longline effort has tended to be concentrated in four main regions, these being off southern and central coast line of eastern Africa, off the northwest coast of Australia and the waters southwest of Australia (Figure 3.4). In the Pacific Ocean there are four main regions of concentrated effort (Figure 3.4). The first region is in the waters west and southwest of Japan (over the Northwest Pacific Basin) between latitudes 25ºN and 40ºN. (A region of lower effort extends west through the central Pacific, north of Hawaii to the waters off Baja California). A second band of concentrated effort stretches across the Pacific at equatorial latitudes, tending to be centred slightly on the northern side of the equator in the western Pacific, and to the southern side in the eastern Pacific. In the southwest Pacific, Japanese longliners have tended to concentrate effort in the waters off eastern Australia, from the Coral Sea down to the Tasman Sea and waters south and southwest of Tasmania. They have also targeted the waters off the west coast of New Zealand. Much of the southern Pacific Ocean is relatively unfished by the Japanese.

Mean annual Japanese longline catches: In the Indian Ocean, Japanese longliners have tended to catch large numbers of striped marlin in a region extending from central east coast of Africa (just north of Madagascar) north into the Arabian Sea, in the Bay of Bengal and in a region northwest and west of Australia (Figure 3.5). In the Pacific Ocean, the highest catch numbers are recorded in a diagonal band running from the northwest region off eastern Japan, through the centralnorth Pacific, across

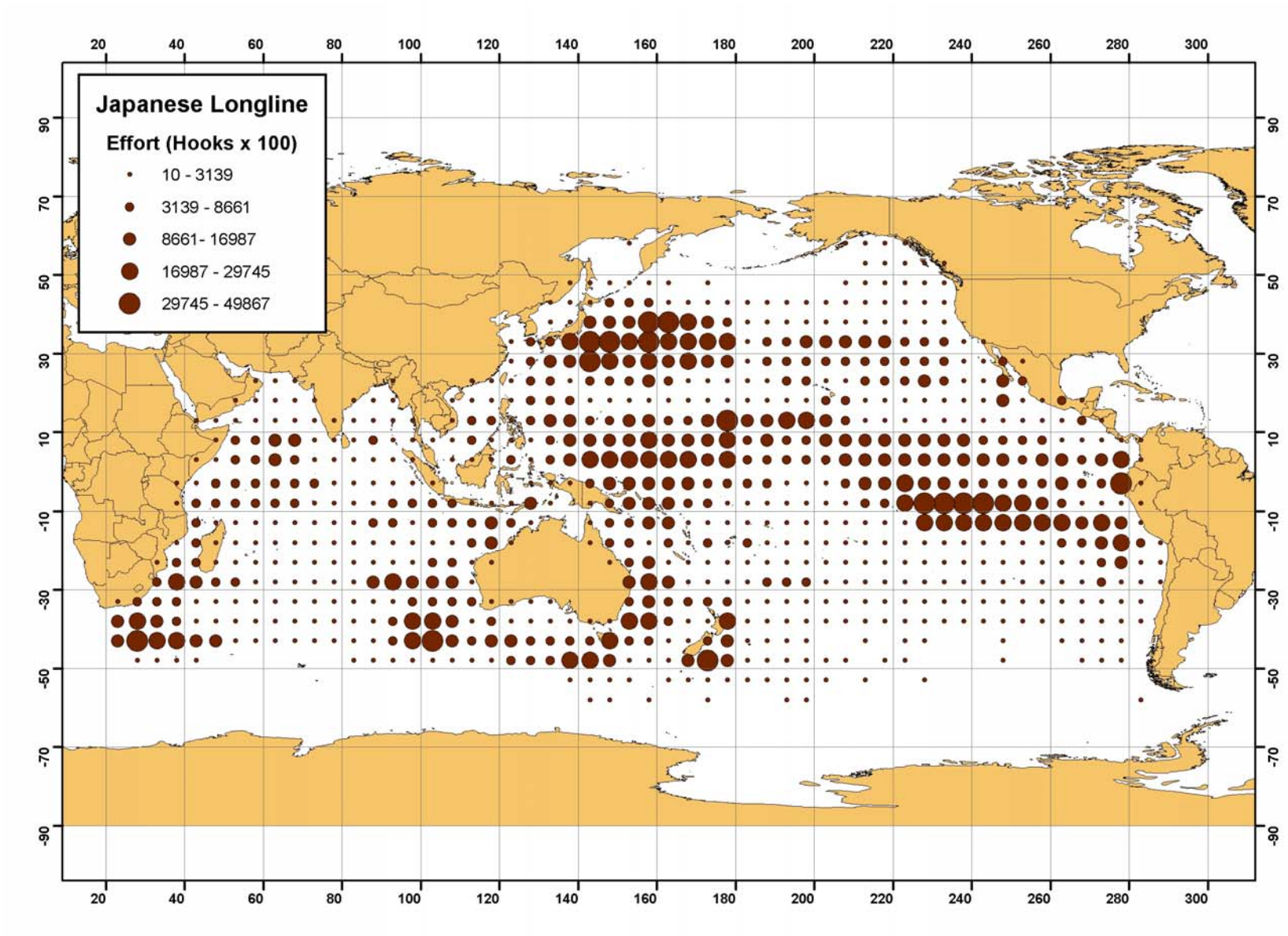

Figure 3.4 – Mean annual effort (hooks) deployed by Japanese longline fishery operating in the Indian and Pacific Oceans during the period 1970-2000 (Source: NRIFSF, 2002; IOTC 2002)

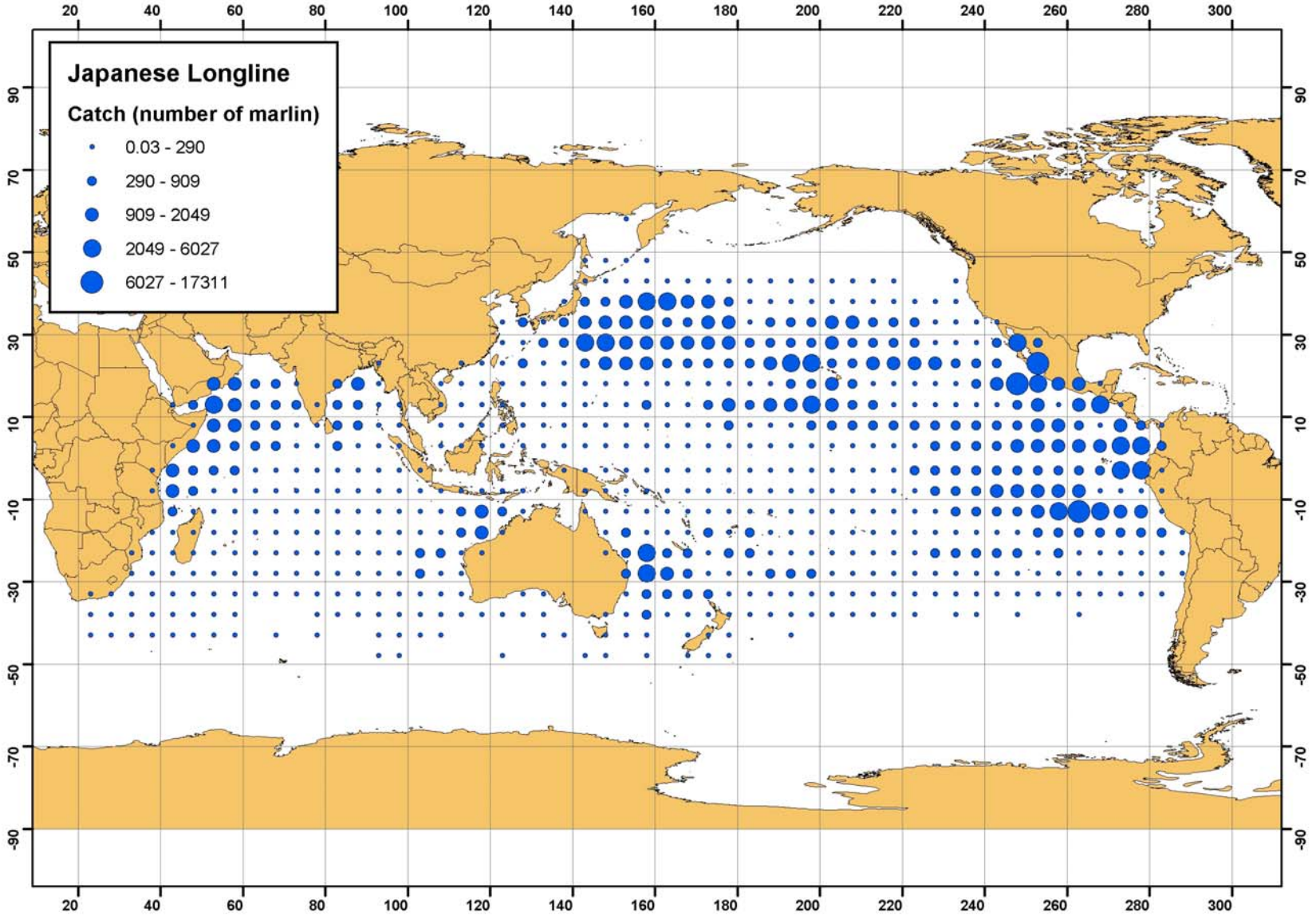

Figure 3.5 – Mean annual catch of striped marlin by Japanese longline fishery operating in the Indian and Pacific Oceans during the period 1970-2000 (Source NRIFSF, 2002; IOTC, 2002)

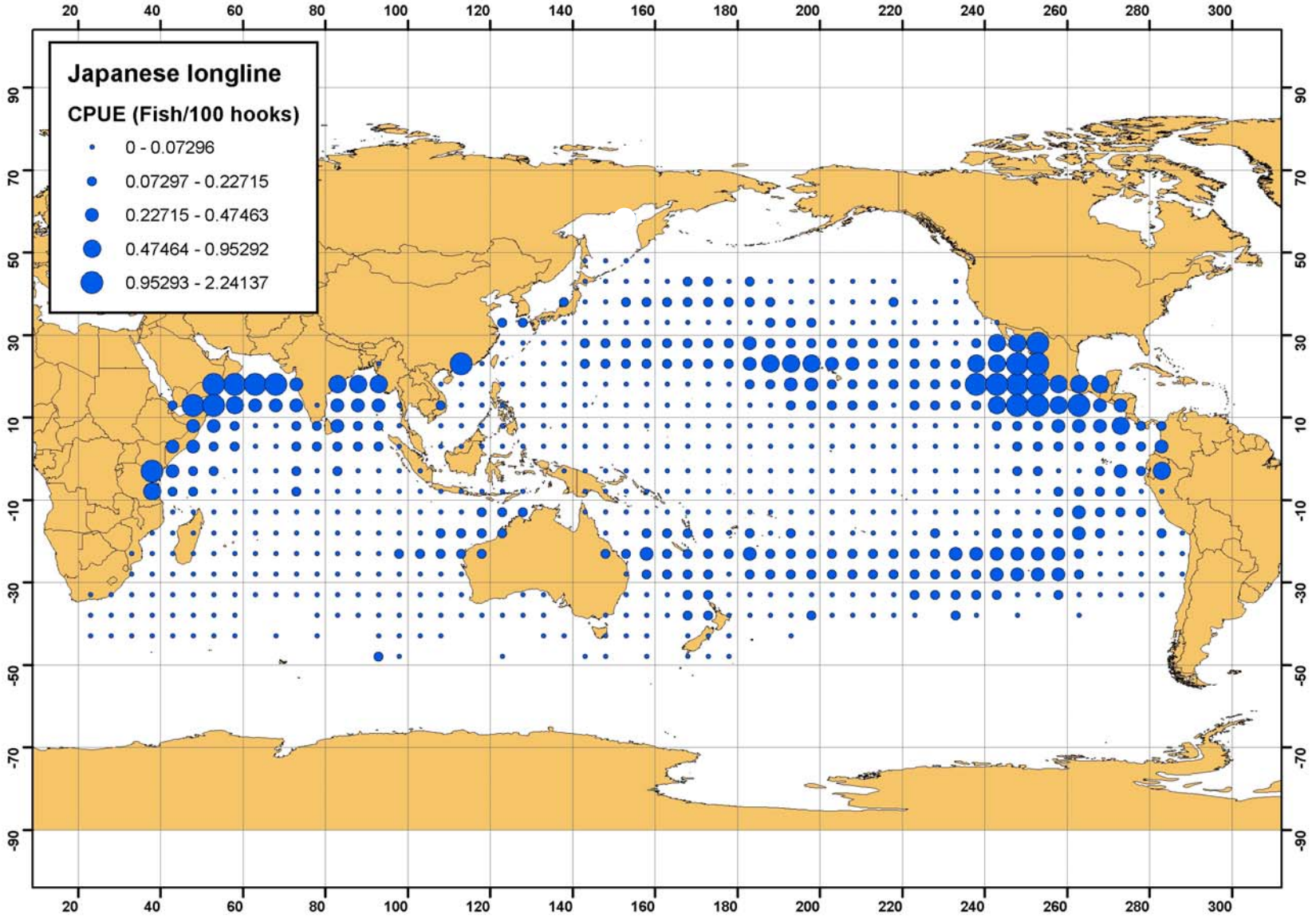

Figure 3.6 – Mean annual CPUE for striped marlin caught by the Japanese longline fishery operating in the Indian and Pacific Oceans during 1970-2000 (NRIFSF, 2002, 2002; IOTC, 2002)

to the west coast of Mexico and down into the southeast Pacific Ocean region, spanning longitudes 140ºW to 80ºW. There are also high catch numbers recorded off the East coast of Australia, the north coast of New Zealand, and to the southeast of Fiji, in the southwest Pacific region. However, regions where large numbers of striped marlin are taken can reflect the expenditure of effort rather than high abundance.

Overall catch rates: The regions of highest catch rates for striped marlin caught by Japanese longliners occur off Baja California in the Northeast Pacific, and in the Arabian Sea in the northwest corner of the Indian Ocean (Figure 3.6). The Bay of Bengal in the Indian Ocean, and the central north Pacific Ocean also have relatively high catch rates of striped marlin, as do waters off northwest Australia (Indian Ocean) and in a band stretching from the east coast of Australia across into the southeast Pacific ocean and up into waters off central America. The only region where catch rates are very high in all four quarters, is off the west coast of Mexico.

Catch rates of striped marlin by quarter: The Japanese longline fleet has operated in both Indian and Pacific Oceans since the 1950s, and given their relatively consistent methods used to target tunas and other species over this period, their CPUE series for these regions is considered to be the most meaningful in terms of fish abundance. In the Indian Ocean during the first quarter, CPUE statistics indicate high abundance (or catch rates) of striped marlin off the central and northeast coastline of Africa, in the Arabian Sea and in the Bay of Bengal (Figure 3.7a). The northwest band of abundance appears to contract northwards in the second quarter, into the Arabian Sea, while there is some evidence for a southward shift of the Bay of Bengal marlin (Figure 3.7b). In the third quarter there is a much lower level of abundance in the Arabian Sea and in the Bay of Bengal, while significantly increased CPUE off northwest Australia may indicate a southeasterly migration by marlin from the Bay of Bengal (Figure 3.7c). There is also evidence for a southward migration of marlin down the east coast of Africa, based on higher CPUEs in the Mozambique Channel between Madagascar and mainland Africa. During the fourth quarter, the region of high catch rates off northwest Australia has expanded westwards, while there is also an increase in catch rates in the Bay of Bengal and waters to south and southwest of this (Figure 3.7d). The only region that has consistently high catch rates year round in the Indian Ocean is the equatorial region off the central East African coast.

In the Pacific Ocean in the first quarter (Figure 3.7a), the highest catch rates occur in the northeast (within 20 degrees of Mexican coast) and southeast regions (within 30 degrees of south American coast), with much lower but significant catch rates in the southwest Pacific ocean (predominantly in the waters between Australia, New Zealand and Fiji, between 20ºS and 40ºS) and in the central northern Pacific, surrounding Hawaii (between 10ºN and 30ºN). The second quarter (Figure 3.7b) is characterised by much lower catch rates in the southwest and south east Pacific, slightly higher catch rates in the south central region, and much higher catch rates in the central north, central north west and north east pacific. The central north catch rates are lower in the third quarter (Figure 3.7c), while the region of extremely high catch rates in the northeast off Baja California expands westward. This quarter also typically has increased catch rates in the southwest Pacific and across the west and central southern latitudes between 15ºS and 30ºS. The higher catch rate zone in the southeast contracts away from the South American coastline. The fourth quarter (Figure 3.7d) is typified by high catch rates in the southwest Pacific, and these extend

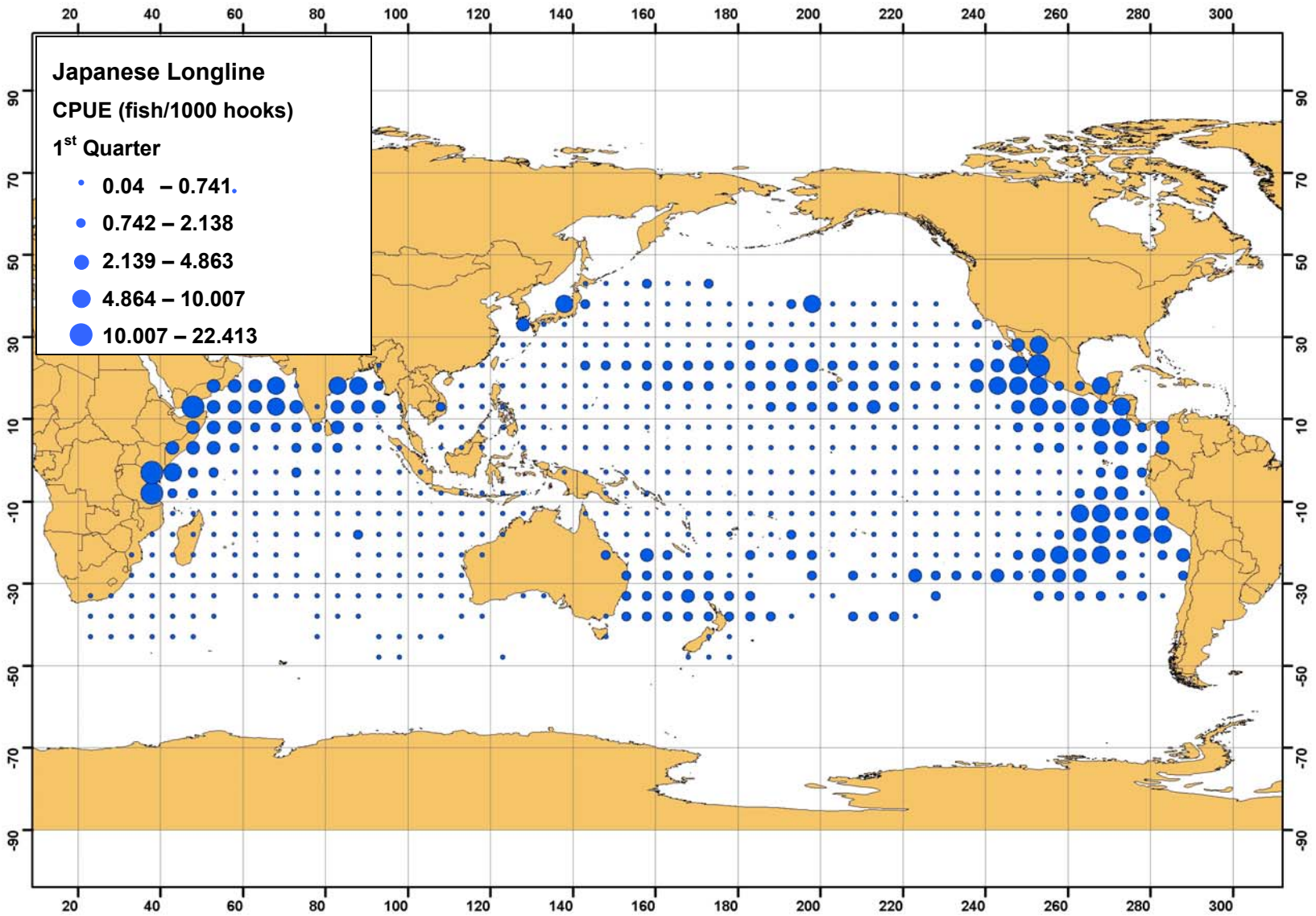

Figure 3.7a – Mean 1st quarter CPUE for striped marlin caught by the Japanese longline fishery operating in the Indian and Pacific Oceans during 1970-2000 (Source: NRIFSF, 2002; IOTC, 2002)

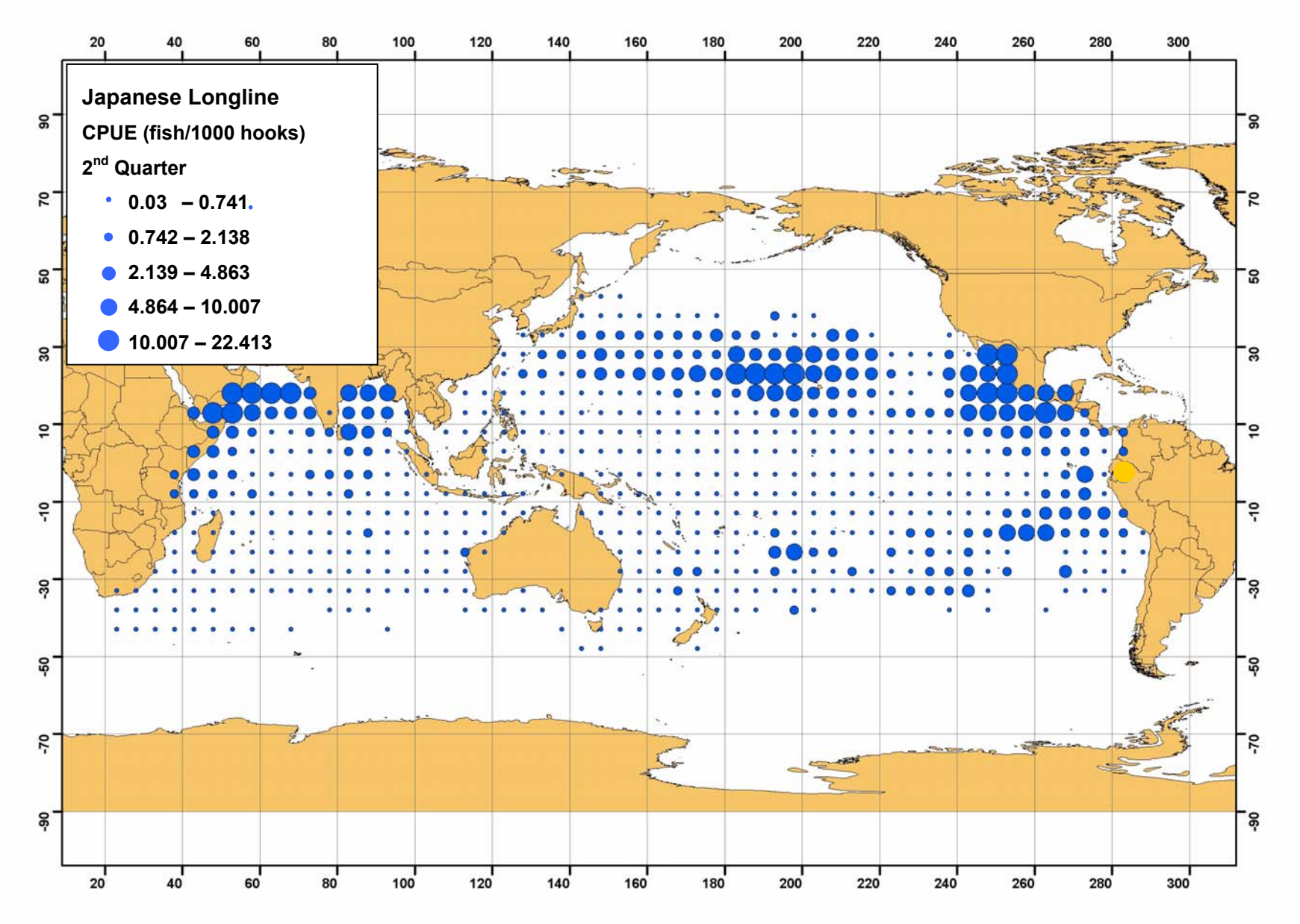

Figure 3.7b – Mean 2nd quarter CPUE for striped marlin caught by the Japanese longline fishery operating in the Indian and Pacific Oceans during 1970-2000 (Source: NRIFSF, 2002; IOTC, 2002)

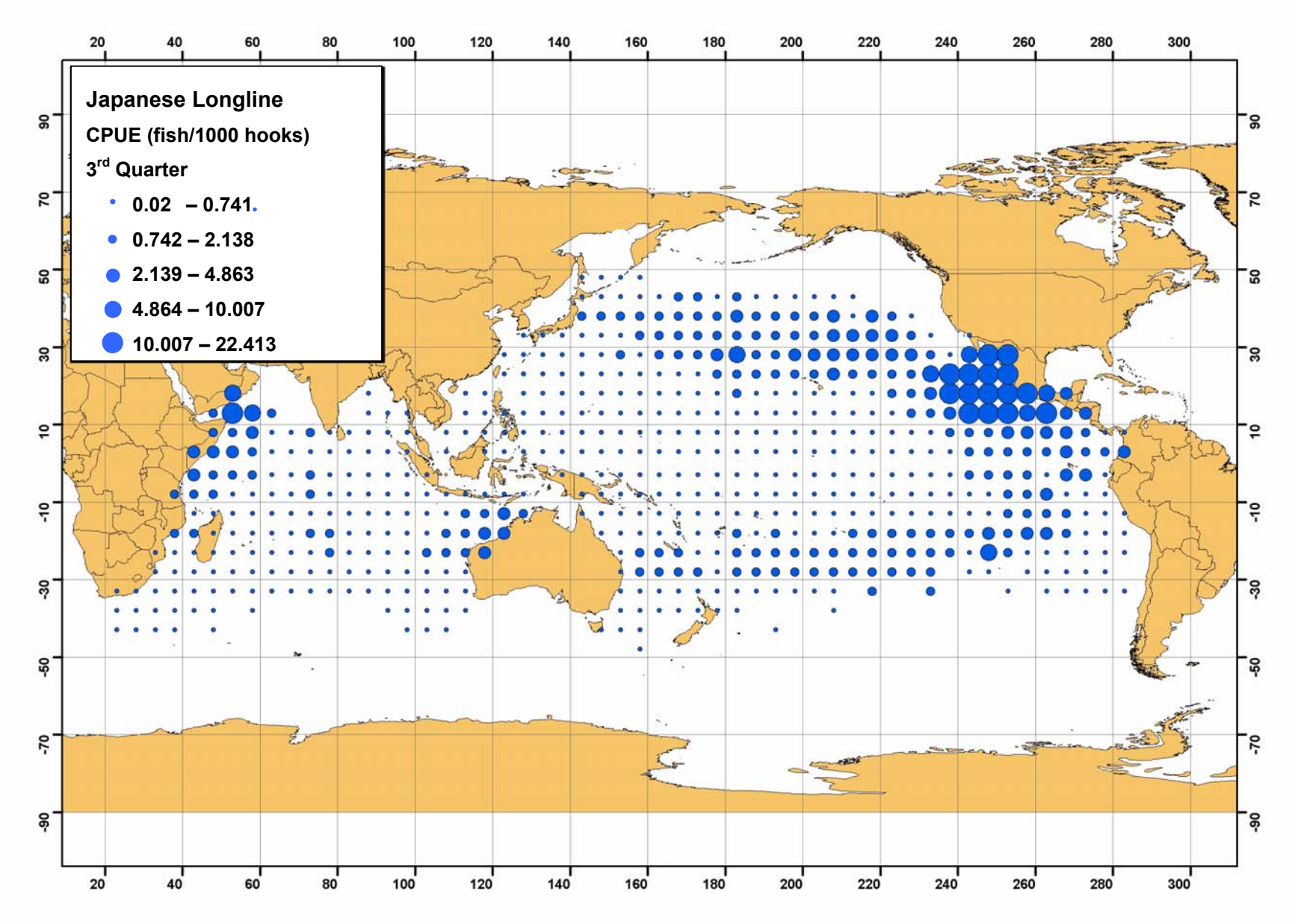

Figure 3.7c – Mean 3rd quarter CPUE for striped marlin caught by the Japanese longline fishery operating in the Indian and Pacific Oceans during 1970-2000 (Source: NRIFSF, 2002; IOTC, 2002)

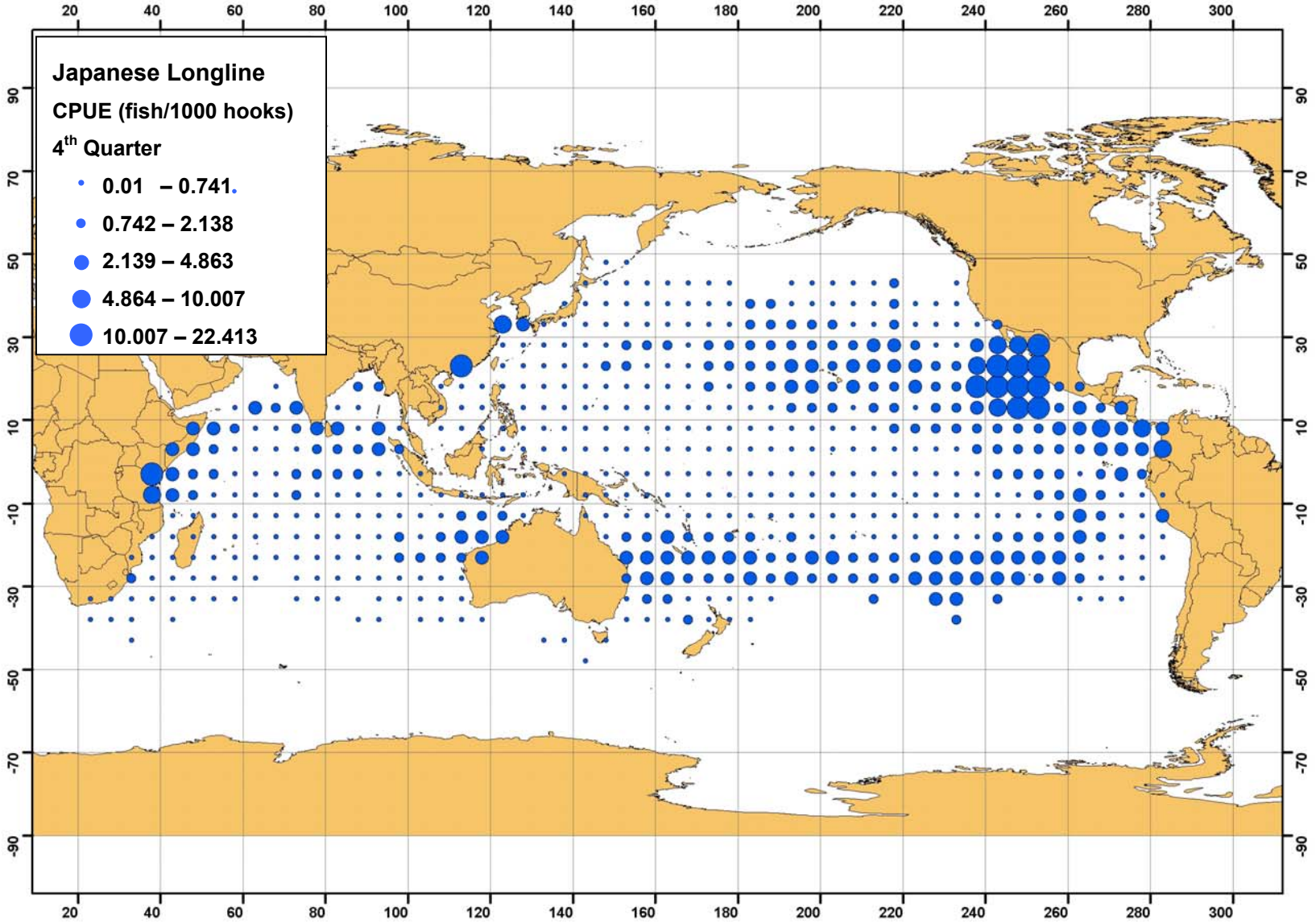

Figure 3.7d – Mean 4th quarter CPUE for striped marlin caught by the Japanese longline fishery operating in the Indian and Pacific Oceans during 1970-2000 (Source: NRIFSF, 2002; IOTC, 2002)

right across the south central Pacific Ocean. Catch rates off Central America are increased, while those in the northeast remain high. The northwest and central north zones of high catch rate have contracted eastwards and southwards towards the Baja region, such that there is very low catch rates in the northwest.

3.4 Pacific Ocean

3.4.1 Introduction

Japanese longliners took the vast majority of striped marlin catch reported in the Pacific Ocean, from the earliest days of the fishery to the present. Total catches in the Pacific Ocean peaked in the mid 1960s (at over 20 000 mt), with most of the catch being taken in the central eastern and northwestern regions. However, Japans total catches and catch rates for striped marlin have been in decline since the late 1960s. Simultaneously, reported catches of "unidentified" marlin by numerous countries has increased from less than 2000 mt to over 15 000 mt annually. Uncertainty over the striped marlin component of total marlin catches has made the assessment of the ocean wide status of this species more difficult. The following sections consider striped marlin catch in the Pacific by gears, countries (fleets) and regions, as well as describing variations in catch rates in different regions.

3.4.2 By Gear

Most of the catch of striped marlin in the Pacific Ocean can be attributed to longline fleets, even though striped marlin are only the 10th most recorded species in longline logs, according to SPC logbook data, comprising only 1% of total catch. Due to its value as sashimi, commercial longliners throughout the Pacific almost always retain this species, unless fishing in waters which prohibit its landing or retention. Very few striped marlin are caught by purse seiners in the WCPO (Williams and Whitelaw, 2000) although Bailey et al (1996) note that about 2% of purse seine sets in the New Zealand skipjack fishery catch striped marlin. Purse seine tends to catch higher numbers of striped marlin around logs (or FADs) than on free sets. Striped marlin are also caught by recreational (sport) and artisinal fisheries. Recreational catches of this species are described in the recreational catch section (Chapter 6). Unfortunately, little is known about the extent to which striped marlin are caught by artisinal fisheries, and gear types such as gillnetting. Ueyanagi et al. (1989) reported that Japan has two other fisheries, the gill-net fishery and the harpoon fishery, that have taken significant numbers of striped marlin through the 1970s and 1980s. The gillnet fishery catch fluctuated between 1000 and 6500 striped marlin per year, while the harpoon fishery catches declined from almost 3000 in 1960 to 300 in 1985.

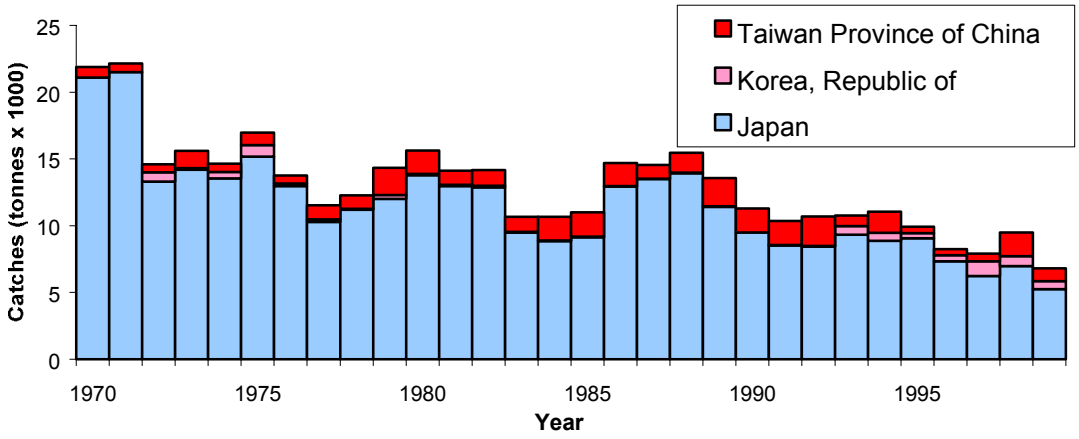

Figure 3.8 - Pacific Ocean catches of striped marlin by country 1970-1999 (Source: FAO, 2002).

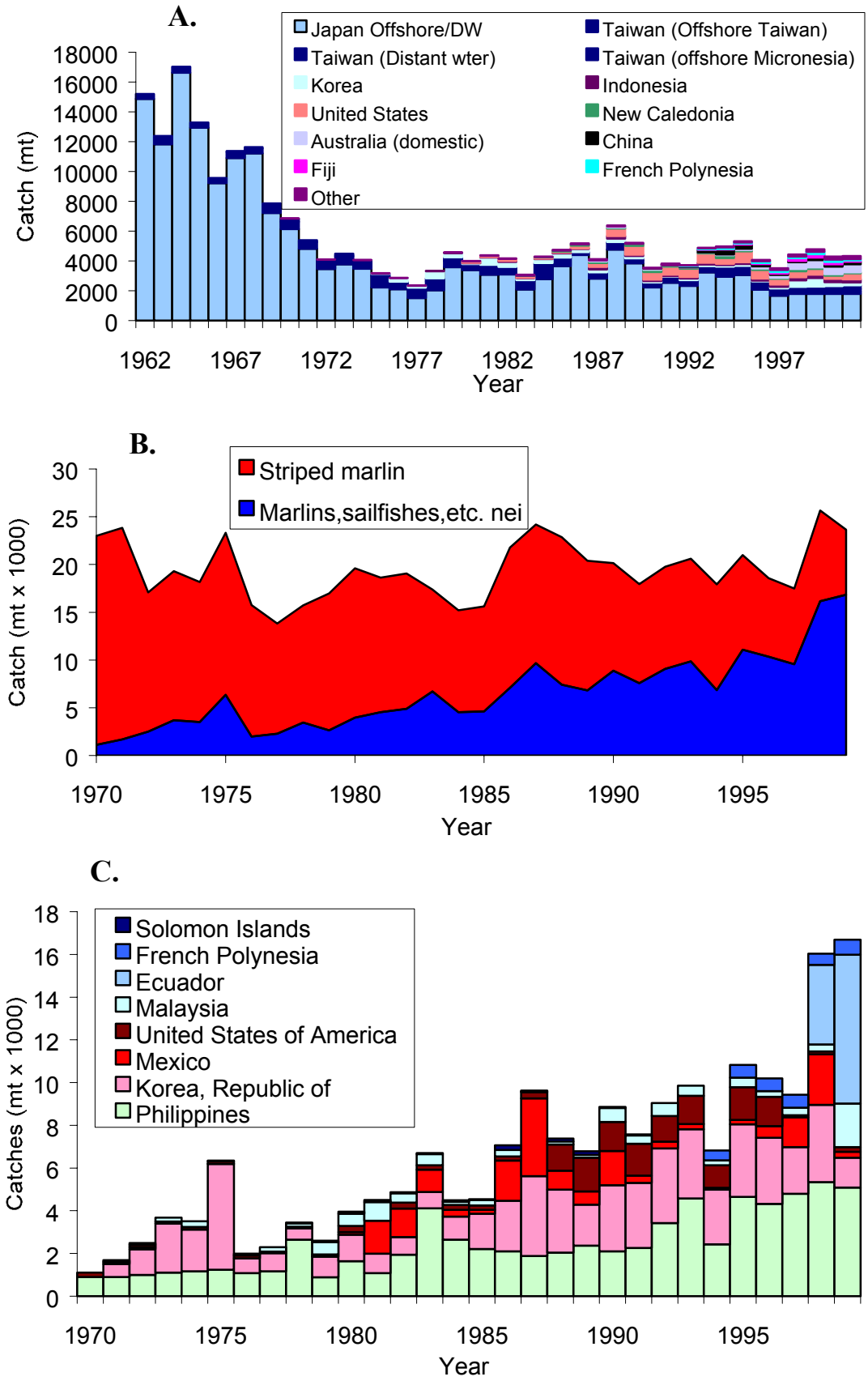

Figure 3.9 – Pacific Ocean catches of; A) striped marlin by country in the WCPO (Source: Williams, 2002); B) striped marlin and unidentified billfish for whole Pacific, and C) "unidentified " billfishes by country for whole Pacific, as reported during the period 1970-1999 (Source: FAO, 2002)

3.4.3 By country

As noted earlier, the catches of striped marlin in the Pacific Ocean have been declining since the 1960s. According to FAO figures, most of the reported catch of striped marlin taken in the Pacific was by Japanese distant water fleets, with Taiwan and Korea also consistently taking significant catches although at much lower (reported) levels (Figure 3.8). However, two trends over the past couple of decades need to be noted in this respect. First, since the establishment of EEZs throughout the region, many countries such as Australia, American Samoa, French Polynesia, Indonesia, New Caledonia, Hawaii (USA) and others have developed their own longline fleets, which while targeting tuna, also may take incidental catches of striped marlin. SPC figures for the WCPO demonstrate the trend in increasing catches of striped marlin by Pacific Ocean nations over the past 10-15 years in particular (Figure 3.9a) (Williams, 2002). Secondly, the proportion of marlin which are reported but not identified to a species level has increased markedly since 1970, such that over 15000 tonnes of "unidentified" billfish are reported annually in the Pacific alone (Figure 3.9b). The proportion of this catch which comprises striped marlin is unknown, but highlights the probability that known striped marlin catch estimates are likely to be highly conservative. Catches of "unidentified billfish" can be predominantly attributed to Philippines and Korean fisheries and more recently, Ecuador and French Polynesia (Figure 3.9c). The United States reported significant numbers of billfish as unidentified from the mid 1980s to the mid 1990s, while Mexican longliners have also sporadically reported high catch levels of unidentified billfish.

3.4.4 Inter-regional trends

There has been a large amount of variation in regional catches of striped marlin in the Pacific Ocean over the past 50 years (Figure 3.10 – based on regions described in Figure 3.2). The western and central (WCPO), southwest (SWPO) and southeastern (SEPO) regions have traditionally accounted for little of total Pacific catch. The WCPO catch fluctuated between 400 and 2000 mt annually, peaking in 1992 at 2004 mt. The SWPO catch peaked at 1642 mt in 1972 and has rarely been above 1000 mt in the period since this. The SEPO catch of striped marlin peaked in 1981 at 2235 mt, and has rarely been over 1000 mt in the past decade. In contrast, the northwest Pacific Ocean (NWPO) and the eastern central Pacific Ocean (ECPO, includes the northeast) have traditionally recorded much higher catches of striped marlin, particularly during the period 1950 to 1980. The NWPO catch peaked at 9305 mt in 1975, but since declined such that this region has not recorded a catch over 5000 mt in the last 10

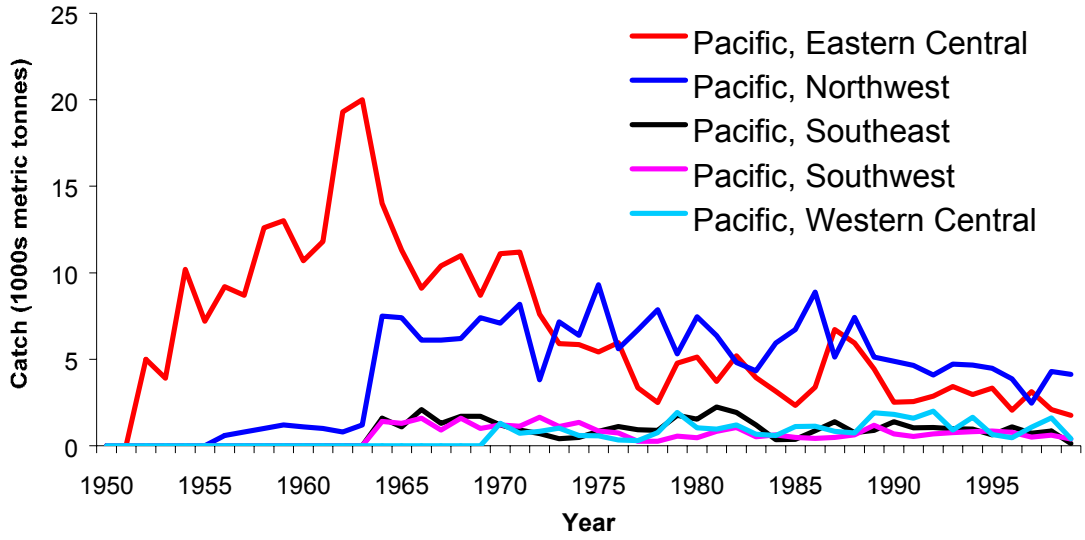

Figure 3.10 – Total catches of striped marlin by all fleets operating in 5 regions of the Pacific Ocean during the period 1950-1999 (Source: FAO, 2002).

years. It still accounts for the highest catches of striped marlin compared to any other region in the Pacific though. This is in contrast to early decades of the longline fishery, during which the annual ECPO catches of striped marlin ranged between 10 and 20 thousand mt (peak catch: 20 000 mt in 1963), representing the largest regional catches of this species anywhere in the world, and at any time in the reported catch history. However, by the mid-1970s these catches had declined to less than 10 000 mt annually, and by the 1990s to less than 4000 mt annually. In 1999, this region only accounted for 1754 mt of the total Pacific wide catch of striped marlin. Total Pacific Ocean catch has varied around 13000 mt from 1972 to the mid-1980s and then has since declined to around 7000 mt by 2000.

3.4.5 Catch rates trends

Introduction: The following section deals predominantly with Japanese, Taiwanese and Korean longline catch and effort data as pertains to catches of striped marlin in the Pacific Ocean over the past 45 years. Pacific-wide catch rates of striped marlin taken by the Japanese fleet declined from between 1.0-1.8 fish/1000 hooks in the 1960s to around 0.40 in the late 1970s and have since fluctuated around this level (Figure 3.11a). Catch rates for the Taiwanese fleet declined from 0.3 marlin per 1000 hooks in 1969 to less than 0.05 in 2000 (Figure 3.11b). In contrast to Japanese and Taiwanese catch rate trends, Korean catch rates have varied markedly over the past 30 years (between 0.02 and 0.8), with peak catch rates occurring in the early 1980s and mid 1990s (Figure 3.11c). It is worth noting that for all three fleets, recent catch rates are the lowest, or close to the lowest, recorded by those fleets since records were first taken. Recent declines in catch rates have also been noted in Hawaiis longline and recreational fisheries, whose catch rate trends have been relatively consistant with Pacific wide Japanese catch rate trends since the 1950s (Dalzell and Boggs, 2003).

The pattern in catch rates for the Japanese fleet varies considerably depending on the region. FAO statistical regions have little relevance to the biology (e.g. distribution and abundance) of striped marlin or of the tuna species which longliners predominantly target. These species distribution, and consequently the distribution of longline effort, tend to vary with latitude. Consequently, the following section considers catch and effort data by latitude, with tropical (10ºS-10ºN), subtropical (10º-30º, N and S) and temperate (30º-50º, N and S) latitudinal regions each considered by longitude also (west, central and east zones) (Figure 3.13).

Tropical zone (10ºS-10ºN): In general, tropical waters have been heavily targeted by Japanese longliners fishing for bigeye and yellowfin tuna, with annual effort consistently varying between 30-90 millions hooks in each of the western, central and eastern tropical sectors (Figure 3.12). However, this level of effort has declined from over 85 million hooks to less than 25 million hooks in both the western and eastern tropics over the past 10-20 years. Regardless of effort, however, catch rates of striped marlin in the western and central tropics have always been extremely low (generally less than 0.2 in the last 20 years). Those in the eastern tropics, which were around 3 fish/1000 hooks in the 1960s, declined and have fluctuated around 0.2 to 0.6 fish per 1000 hooks during the past two decades.

Subtropical zone (10ºN-30ºN, 10ºS-30ºS): In the northern hemisphere, the western subtropical zone have typically had the greatest concentration of subtropical effort (15-64 million hooks annually), while the central zone has been typified by intermediate levels (8-32 million hooks) and the northeast subtropics the lowest historic effort levels (0.18 to 14 million) (Figure 3.12). In each region, effort has been declining and is currently at the lowest levels experienced in the past 20 years. In contrast to the east to west trend of increasing effort, catch rates have typically been lowest in the northwest subtropics (0.2-1.3 fish/1000 hooks), followed by generally higher rates in the central zone (0.3-5.1), and drastically higher catch rates in the northeast subtropics (generally between 5.0 and 18.1, however, there have also been a few years of exceptionally low catch rates). In the central and eastern regions of

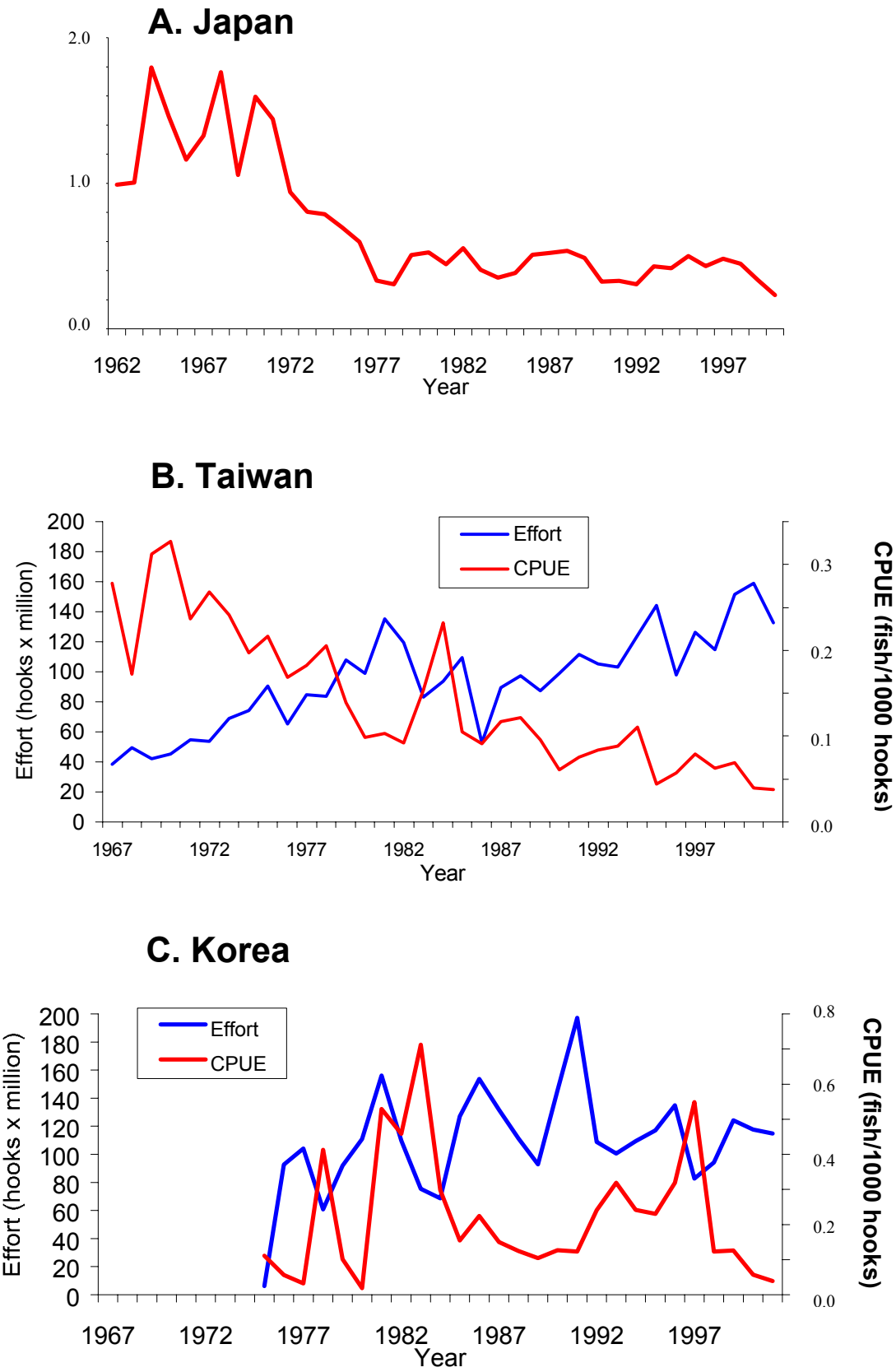

Figure 3.11 – Annual effort and catch per unit effort (CPUE) for striped marlin taken by a) Japanese longliners; b) Taiwanese longline, and; c) Korean longline fleets operating in the Pacific Ocean during the period from 1962 to 2000 (Source: NRIFSF, OFDC, NFRDI, 2003).

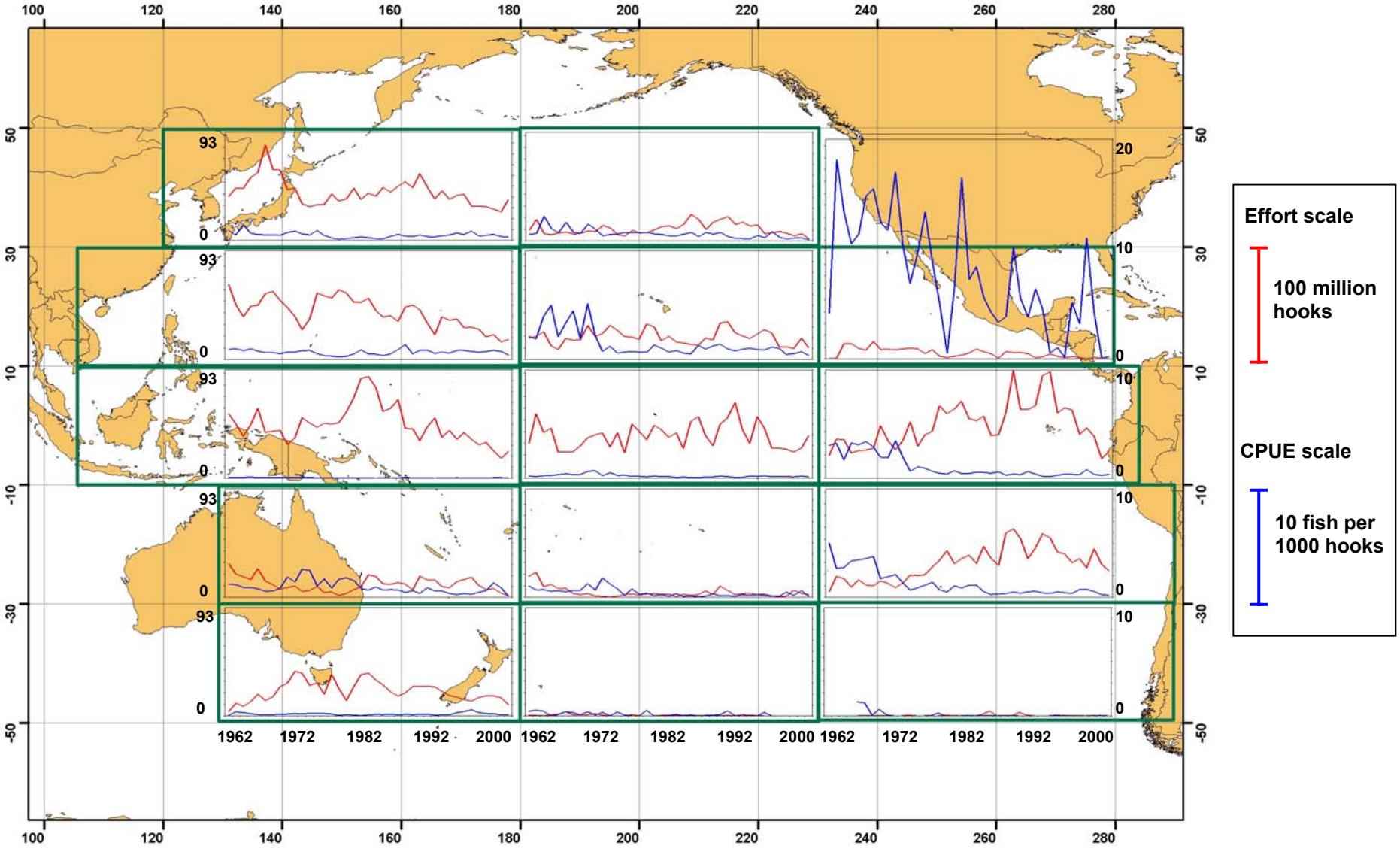

Figure 3.13 – CPUE and effort (hooks) for catches of striped marlin in Pacific Ocean regions by Japanese longliners during the period 1962-2002.

the northern subtropics, there is an apparent decline in catch rates from the highs recorded in the 1960s. In the southern subtropical zone (10ºS-30ºS), the eastern region has typically had the greatest concentration of subtropical effort (9-59 million hooks annually), while the central region has been typified by extremely low levels (1-9 million hooks annually over past 20 years) and the southwest subtropics an intermediate annual effort level (1.5-28 million) (Figure 3.12). In the east, effort increased until the mid 1980s and has since been declining. In the west, effort has fluctuated around 10-15 million hooks, but declined to 1.5 million in the past decade. Catch rates in the southeast subtropics declined from around 4.0 in the 1960s to less than 1.0 by the early 1980s and has remained low since. The central region has been typified by extremely low catch rates since the mid 1970s. The southwest subtropics however, experienced the highest catch rates for striped marlin during the 1970s (~2.0), and catch rates have since varied between 0.2 and 1.3.

Temperate waters (30ºN-50ºN, 30ºS-50ºS): In general, western temperate waters in both the north and southern hemispheres have been heavily targeted by Japanese longliners. In the northwest (24-81 million hooks annually), the longliners targeted mainly albacore and SBT while in the southwest temperate zone, they concentrated on catching southern bluefin tuna (3-38 million hooks annually). The central-north temperate zone had generally lower but significant effort levels (1.6 to 22 million). The level of annual effort in these regions has been declining for over a decade. The southern central and south east temperate waters had virtually no effort expended in them. The catch rates for striped marlin in the southern temperate waters, from east to western Pacific, were typically very low (generally less than 0.5). Catch rates in the northern temperate waters were generally higher, between 0.1 and 1.4 fish per 1000 hooks in the west, while fluctuating at a similar level in the central temperate waters after declining from higher catch rates in the 1960s (1.5-2.2 fish per 1000 hooks).

3.5 Indian Ocean

3.5.1 Introduction

Overall reported catches of striped marlin in the Indian Ocean are much lower than in the Pacific, with the majority taken by Taiwanese longliners. Catches are currently evenly divided between the east and west Indian Ocean regions but both are now dwarfed by the reported catches of "unidentified" billfish, which increased to over 15 000 mt in the mid 1990s, with Sri Lanka, India and Pakistan gillnet fleets largely responsible for this trend. The striped marlin component of this could be significant given the seasonally high abundance of this species in the Bay of Bengal and nearby waters. Based on Japanese and Taiwanese longline records, catch rates have declined from the early 1960s to present day, in the face of continually increasing effort levels by longline fleets. As in the Pacific Ocean, it is difficult to interpret falling catch rates, given changes in targeting and distribution of the fleet, and unknown catch levels of striped marlin by gillnet. Attempts by fishery scientists to standardise longline catch rates in the Indian Ocean are reviewed in Chapter 4.

3.5.2 By Gear

In the Indian Ocean, most of the "identified" catch of striped marlin is reported by longline fisheries. Historically, longline catch has fluctuated significantly, with whole ocean catches peaking over 5000 mt in 1967, 1978, 1981, 1987 and 1993; while lows of less than 2000 mt were recorded in 1963, 1973, 1990 (Figure 3.13a). Reported catches of striped marlin by other gears has typically been very low (Figure 3.13b) and only reported since the mid 1980s. However, it should be noted that large purse seine fleets operate in the Indian Ocean, and this fishing method typically has a significant bycatch of marlin species. However, the extent of

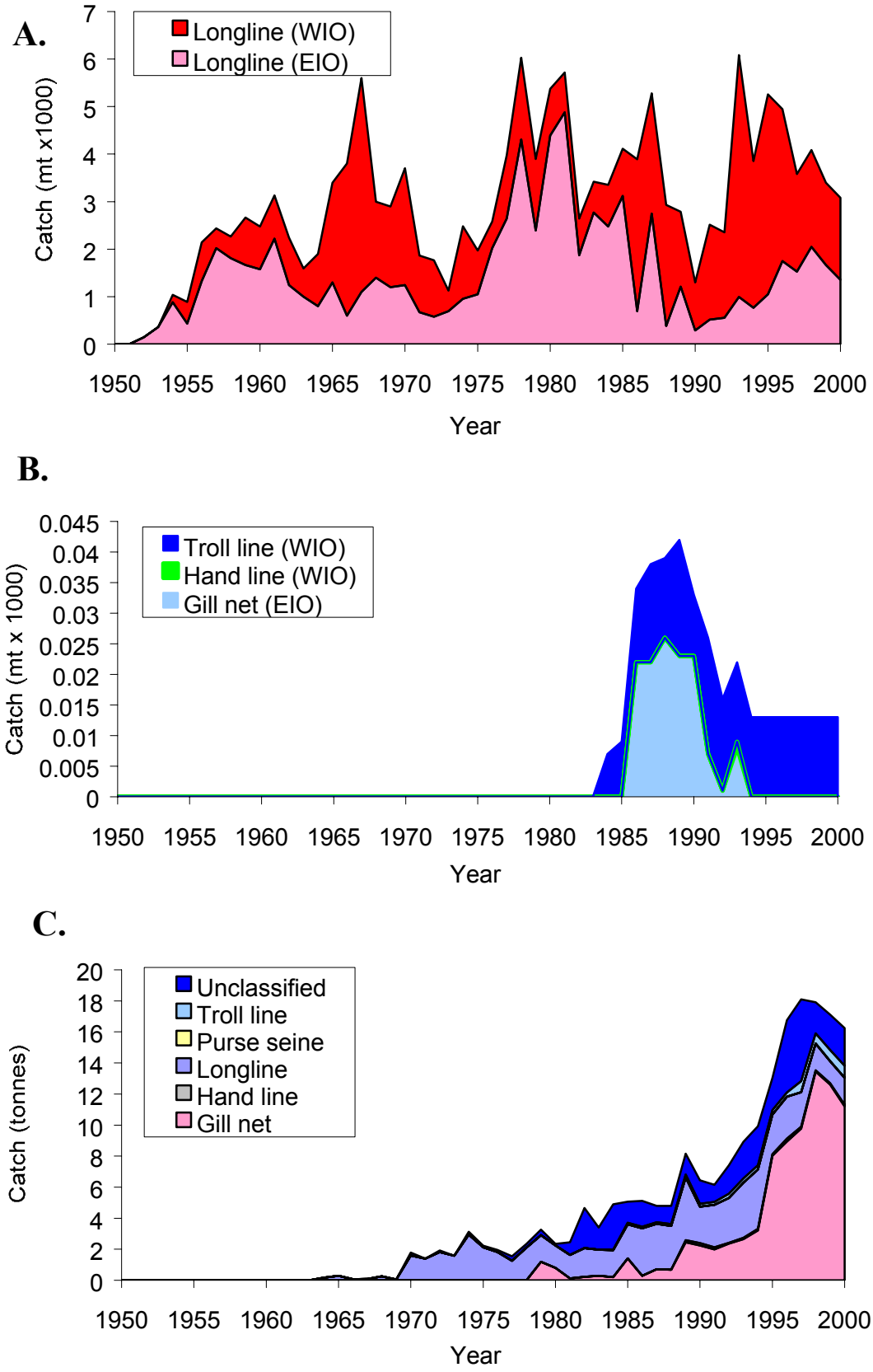

Figure 3.13 – Indian Ocean reported catches of, a) striped marlin by longline in the east and west regions, b) striped marlin by other gear types, and c) Unidentified billfish. (Source IOTC, FAO, 2002).

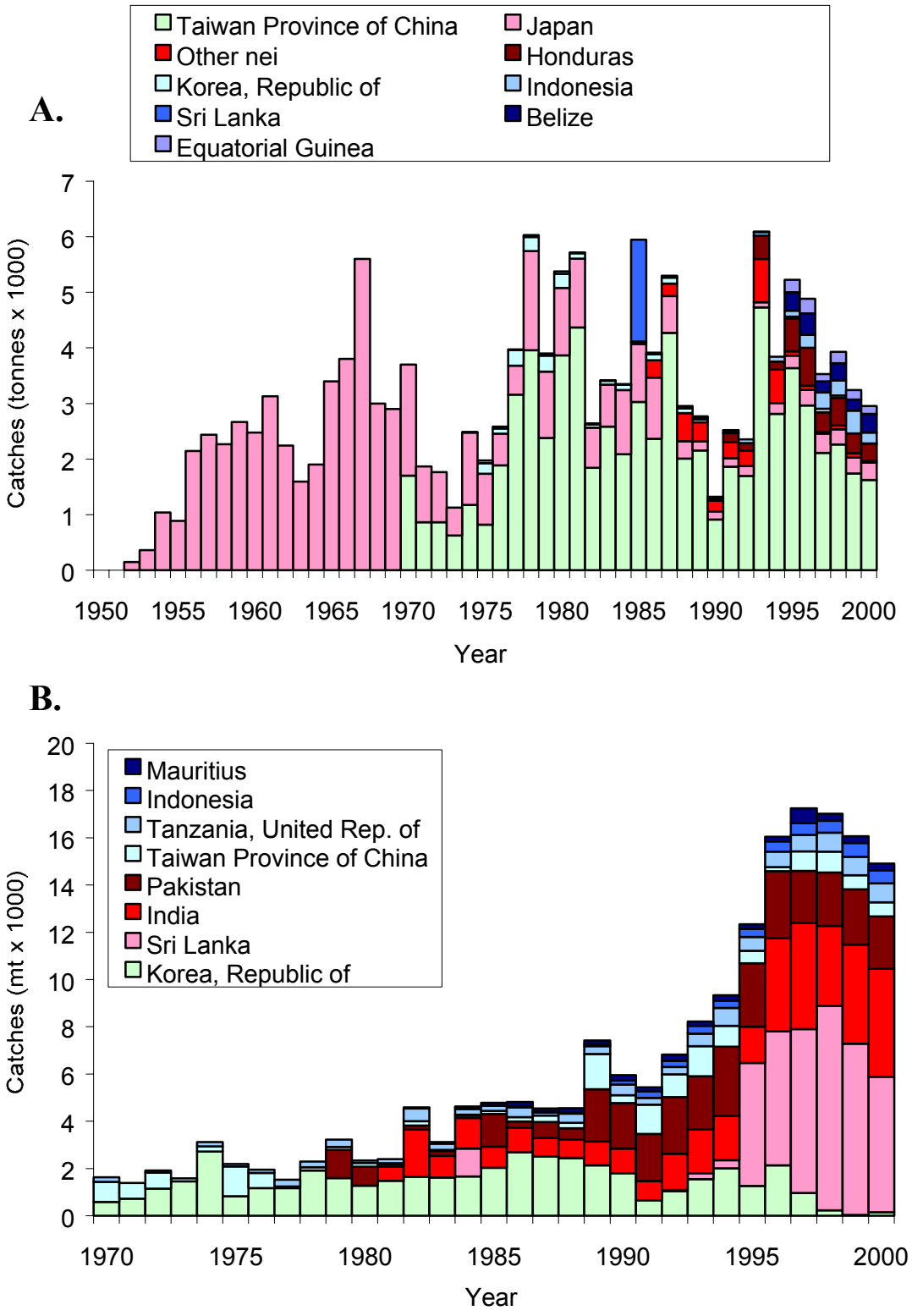

Figure 3.14 – Reported catches in the Indian Ocean of, a) striped marlin by flag during the period 1950-2000, and b) unidentified billfish by flag, during the period 1970-2000 (Source, IOTC, FAO, 2002)

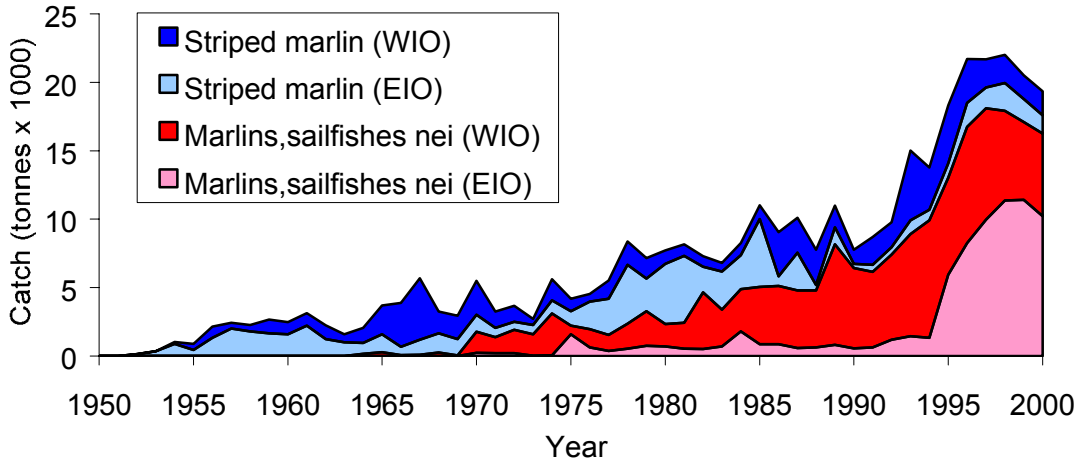

Figure 3.15 – Comparison of striped marlin and unidentified billfish catches in the eastern and western Indian Oceans during the past 50 years (Source: FAO, 2002).

this bycatch is rarely recorded, and therefore the true level of marlin catches is difficult to estimate in this region, but likely to be considerably greater than estimated from longline reporting. Annual catches of "unidentified" billfish have risen to over 15 000 mt, and most of this can be attributed to gillnet fisheries, with smaller but significant reporting of unidentified marlin reported by longline and other unclassified methods (Figure 3.13c). The reported level of "unidentified" billfish catches increased rapidly since 1980, due mainly to the expansion and increased reporting by gillnet fisheries. The proportion of this catch which comprises striped marlin is unknown, but it is believed that much of the gillnet catch of billfish comprises sailfish, and blue and black marlin (Anon., 1995). However, given species misidentification issues and underreporting, the catch of striped marlin may be significant, given that gillnet fisheries are predominantly based in the northern waters where striped marlin are seasonally abundant.

3.5.3 By Country

Between 1950 and 1970, Japan was the only country to report catches of striped marlin by longline in the Indian Ocean, with these catches peaking at over 5000 mt in 1967 (Figure 3.14). However, since then Japans longline catch of striped marlin has declined such that it is now only a few hundred tonnes. From the mid-1970s onwards, Taiwan has reported the largest annual catches of striped marlin by any single fishing nation. During the second half of the 1990s, significant longline catches were also recorded in the Indian Ocean by vessels registered to Indonesia, Honduras, Equatorial Guinea and Belize.

Between 1970 and 1983, the majority of "unidentified" billfish caught in the Indian Ocean were reported by the Republic of Korea (Figure 3.14b). Indian longline and Pakistan gillnet catches of unidentified billfish started increasing from the early 1980s, while Sri Lankas gillnet fleets reported over 5000 mt annually from 1996 onwards.

3.5.4 By Region

Total catches of striped marlin in the eastern and western Indian Ocean have fluctuated over the past 50 years. The eastern Indian Ocean accounted for the majority of striped marlin caught by longline between the mid-1950s and mid-1960s, and the mid-1970s-mid1980s. The western Indian Ocean had higher catches than the east in the intervening periods, excepting the second half of the 1990s, when total catches in each region were roughly equal (Figure 3.15). Catches of "unidentified" striped marlin increased significantly in the past decade in the Eastern Indian Ocean, such that this region now accounts for the majority of "unidentified" catch.

3.5.5 Catch rates and effort analysis

In the Indian Ocean, combined catch rates for striped marlin caught by longliners from Japan, Taiwan and Korea have shown a general pattern of decline since the late 1950s, from 2.0 to 0.1 fish per 1000 hooks, while total longline effort has steadily increased over this period (Figure 3.16). However interpreting combined fleet data is difficult due to different gears, methods and targeting histories. When assessed by individual fleet, the same general trends are apparent (Figure 3.16). The Japanese catch and effort records are the most complete and indicate a similar decline in CPUE to that for the combined fleets analyses. The Korean data is relatively discontinuous and shows no real long-term trend in CPUE. However, the Taiwanese longline CPUE for striped marlin shows extremely similar levels and patterns in CPUE to those recorded by Japanese longliners, in the 1970s and 1980s. It should be noted that since the late 1980s, Taiwanese longline effort in the Indian Ocean has outstripped that of Japanese longline fleet. Trends in Japanese and Taiwanese effort and CPUE data for striped marlin vary by latitude in the Indian Ocean, as they do in the Pacific Ocean.

Tropical zone (10S-10N): Japanese longliners concentrated considerable fishing effort in the western tropical zone of the Indian Ocean (Figure 3.17) in the 1960s, the 1980s and the mid-1990s (20-34 million hooks during these periods). Catch rates of striped marlin were relatively high (1.0 to 3.7 fish per 1000 hooks) until the early 1980s, after which they declined to below 0.5. Taiwanese effort in this same region increased from the late 1980s to the current level of around 150 million hooks, while their catch rate trend for striped marlin was similar to that of Japan, declining from a peak in the late 1970s. Catch rates for both fleets appear highest during periods when effort was lowest in this region, and the lowest catch rates coincide with the massive increase in longline effort in this region in the 1980s and 1990s. In the eastern tropical zone, both Japanese and Taiwanese effort has fluctuated at a more intermediate level (0.5-12 million hooks annually for Japan, and 4-32 million for Taiwan), while catch rates range between 0.1-1.6 (Taiwan) and 0.1-4.00 (Japan). There are no clear trends of decline or increasing catch rates over this period, although catch rates were higher in the late 1970s and early 1980s in this region.

Sub-tropical zones (10N-30N, 10S-30S): Neither Japan nor Taiwan have concentrated much fishing effort in the northern subtropical region of the Indian Ocean, yet both fleets have recorded extremely high (and highly variable) catch rates for striped marlin in this region over the past 50 years (Figure 3.17 and 3.18). Furthermore, peaks and trends in striped marlin CPUE are quite similar for both fleets operating in the northern waters in the late 1970s and through the 1980s, although actual CPUE is generally lower for Taiwanese longliners. In contrast, while Japanese (and to a lesser extent, Taiwanese) fishing effort has been higher in the southern subtropical waters, catch rates for striped marlin are much lower than in the northern subtropical region. In the southwest subtropical zone Japanese CPUEs for striped marlin have declined from around 0.5 fish per 1000 hooks in the 1950s, 60s and 70s, to current levels of almost zero.

Temperate zone (30S-50S): Despite the massive longlining effort expended by Japan and Taiwan in the south west temperate zone, and by Japan in the south east temperate zone (targeting southern bluefin tuna), catches of striped marlin in these waters are rare and catch rates have always been extremely low (Figures 3.17 and 3.18). This zone is on the very edge of striped marlin distribution in the Indian Ocean.

3.6 Summary and conclusions

This chapter has detailed the striped marlin catch histories for various fleets and gears, in both the Indian and Pacific Oceans over the past 50 years. In doing so, it has highlighted a number

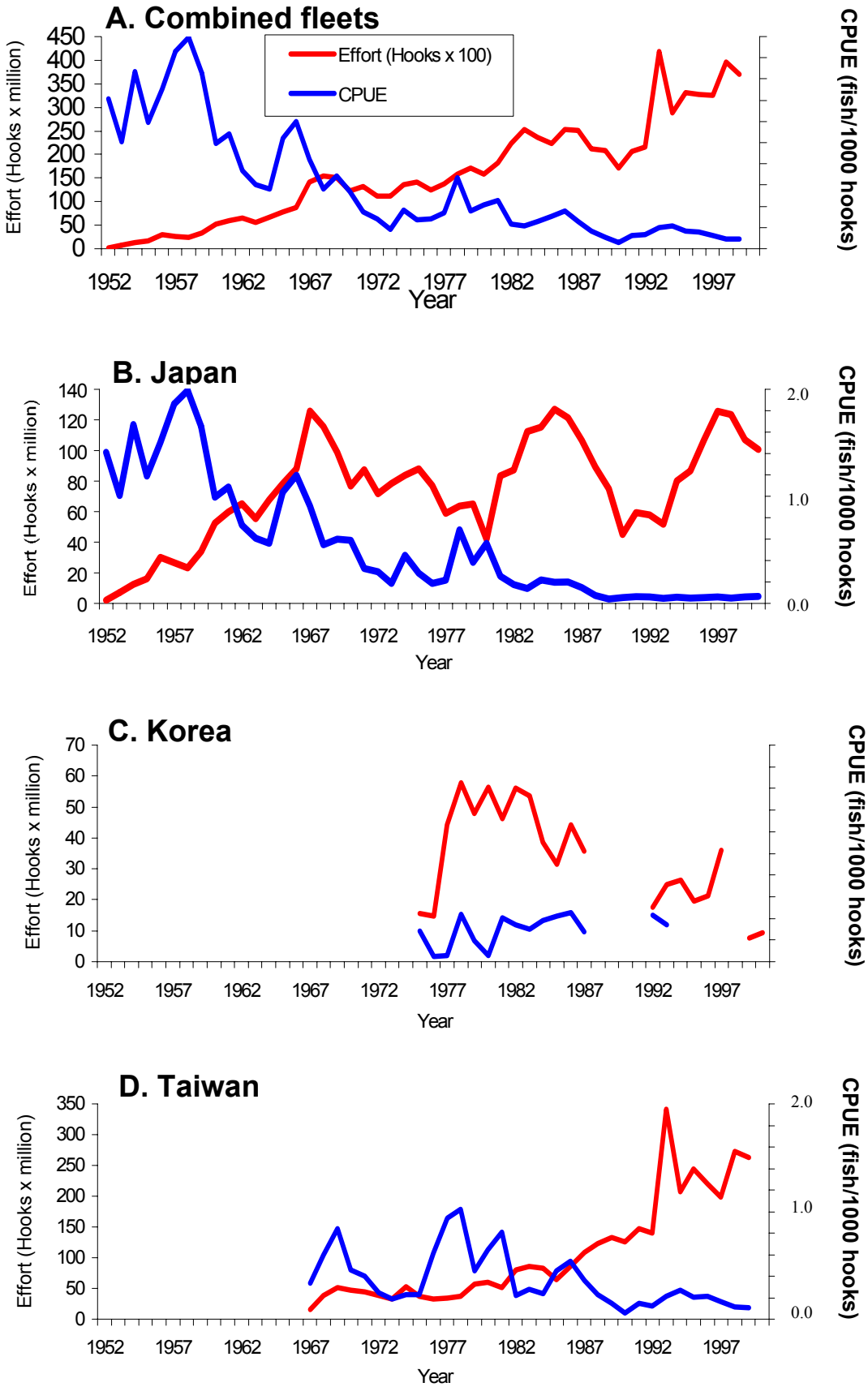

Figure 3.16 – Striped marlin catch rates and longline effort for a) Japanese, Taiwan and Korean fleet data combined for the Indian Ocean. b) Japanese fleet only; c) Korean fleet only; d) Taiwanese fleet only, in the Indian Ocean during the period 1952-2000 (Source: NRIFSF, OFDC, NFRDI, IOTC, 2002).

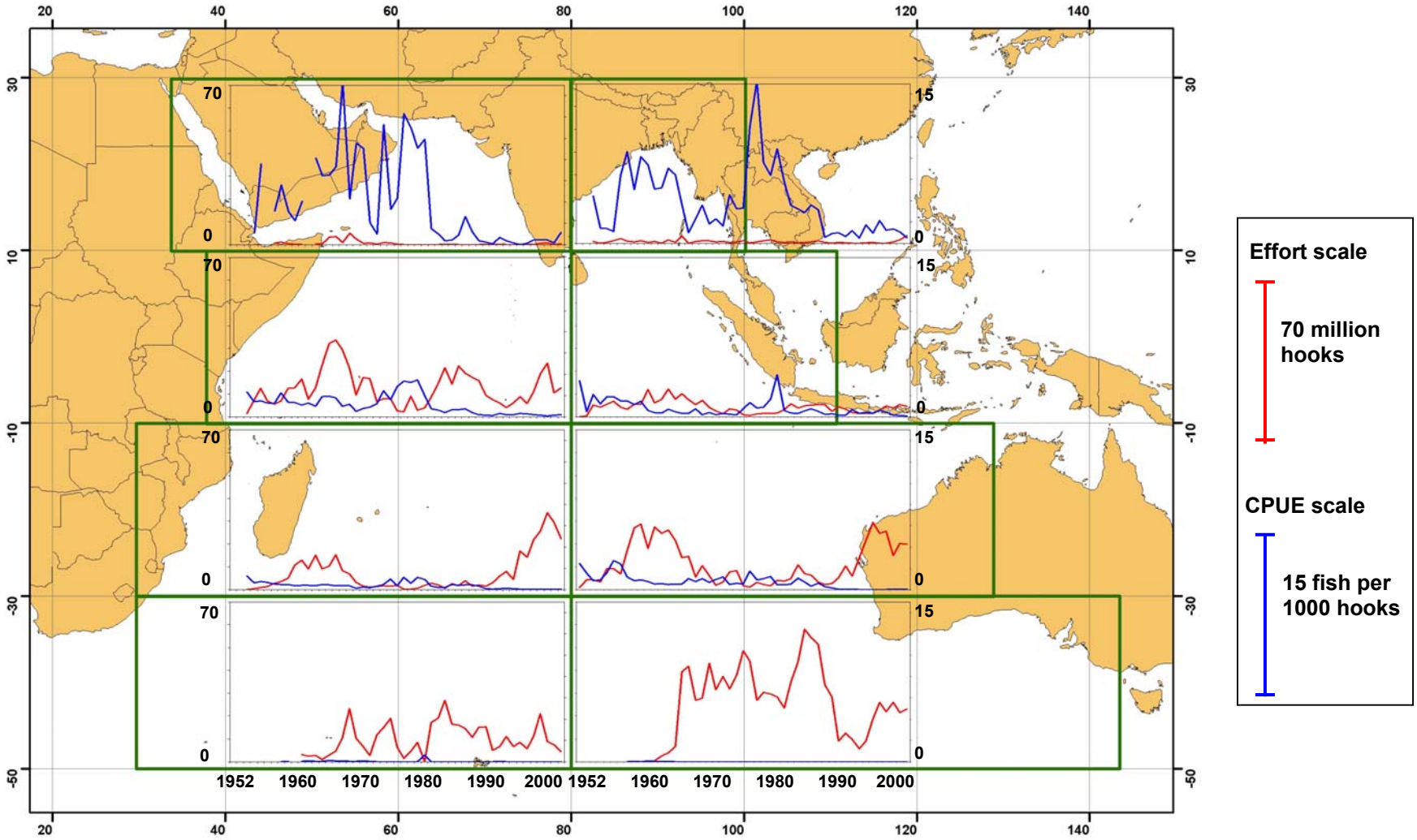

Figure 3.17 – Japanese longline effort (red line, scale: 0-70 million hooks) and striped marlin CPUE (blue line, scale: 0-15 fish per 1000 hooks) in the tropical (10S-10N), subtropical (10N-30N, 10S-30S) and temperate (30S-50S) latitudes of the Indian Ocean, over the period 1952-2000. (NRIFSF, 2002).

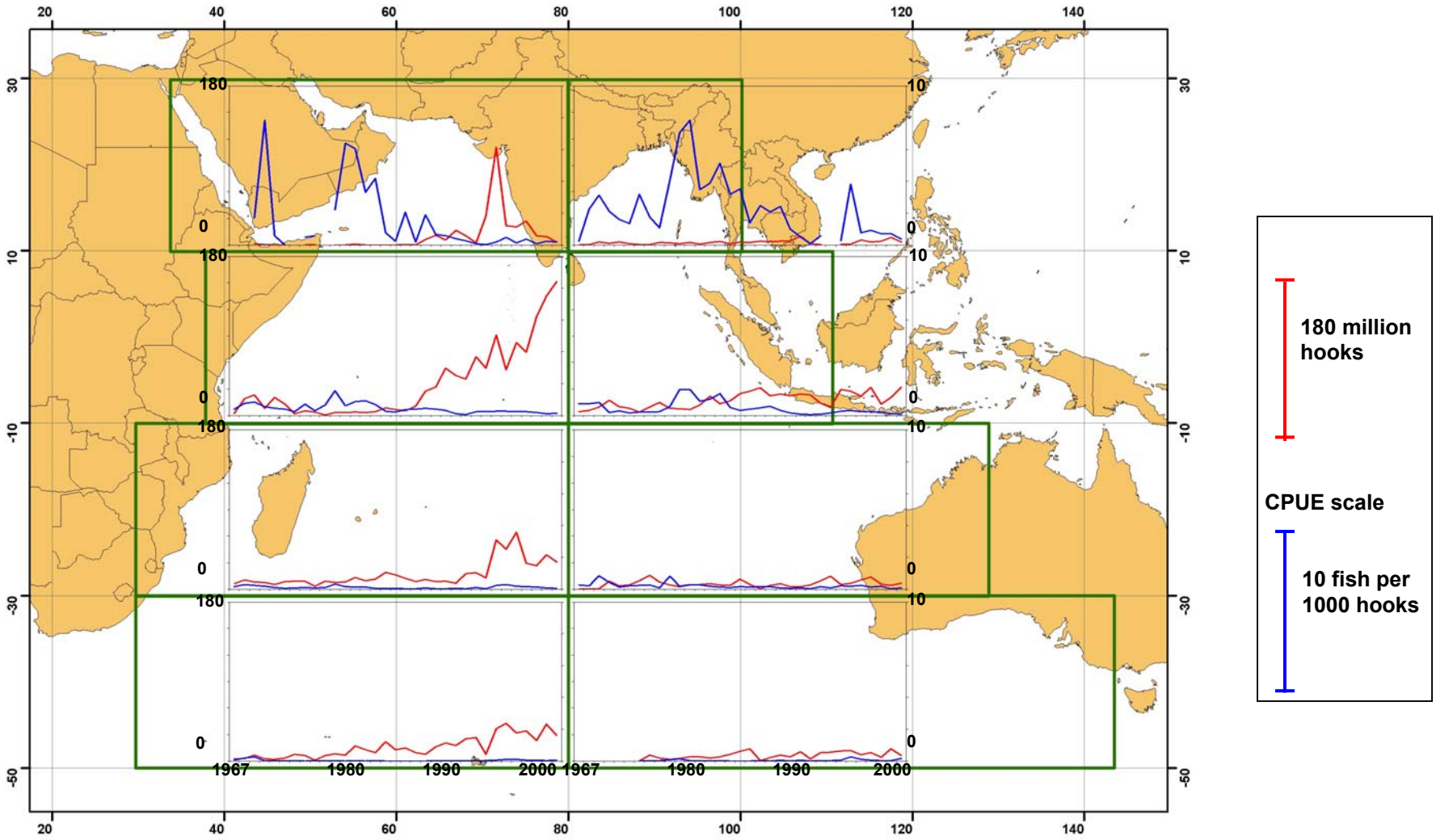

Figure 3.18 – Taiwanese longline effort (red line, scale: 0-180 million hooks) and striped marlin CPUE (blue line, scale: 0.0-10 fish per 1000 hooks) in the tropical (10S-10N), subtropical (10N-30N, 10S-30S) and temperate (30S-50S) latitudes of the Indian Ocean, over the period 1952-2000. (OFDC, 2002)

of fisheries trends which are important to gaining an understanding of historical fishing pressure that has been applied to this species, and more importantly, will help in understanding why the assessing the stock status of this species (the subject of the next chapter) has proven to be such a complicated and problematic task.

It is clear that the majority of the reported global catch of striped marlin over the past 50 years has been taken by the Japanese longline fleet. In the Indian Ocean, however, Taiwan essentially replaced Japan as the main fleet catching striped marlin from the early 1970s onwards. In the Pacific Ocean, Japans annual catch also declined, in part due to their exclusion and restricted access to fishing in a number of EEZs which contained high abundance regions for striped marlin, as well as partly due to targeting shifts (potential abundance declines will be discussed later). However, in the past 10-15 years, the decline in Japanese catches has been offset somewhat by the development of longline fleets by numerous Pacific and Indian Ocean nations. Some of these fleets now take significant and increasing numbers of striped marlin (e.g. Australia, Fiji, New Caledonia to name a few). On top of this, the tonnage of "Unidentified" marlin catch being reported has risen substantially, with striped marlin making up an unknown component of this.

These catch trends have occurred during a period in which catch rates for striped marlin, as reported by both Japanese and Taiwanese fleets in both the Indian and Pacific Oceans, have substantially declined. While shifts in fishing methods, species targeting and in spatial distribution of fishing effort may explain some of the decline in catch rates, there is real concern that they may also signify a decline in abundance. Attempts to unravel these relationships and assess the stock status of striped marlin are reviewed in the following chapter.