



**SCIENTIFIC COMMITTEE
FOURTH REGULAR SESSION**

11-22 August 2008
Port Moresby, Papua New Guinea

**OVERVIEW OF THE INTERACTION BETWEEN SEABIRD AND TAIWANESE
LONGLINE FISHERIES IN THE PACIFIC OCEAN**

WCPFC-SC4-2008/EB-WP-5

Hsiang-Wen Huang¹, Ke-Yang Chang² and Ju-Ping Tai³

¹ National Taiwan Ocean University, Keelung

² Fisheries Agency, Council of Agriculture, Taipei

³ Overseas Fisheries Development of Council, Taipei

Overview of the interaction between seabird and Taiwanese longline fisheries in the Pacific Ocean

Hsiang-Wen Huang¹, Ke-Yang Chang² and Ju-Ping Tai³

¹ National Taiwan Ocean University, Keelung

² Fisheries Agency, Council of Agriculture, Taipei

³ Overseas Fisheries Development of Council, Taipei

SUMMARY

Noting the increasing global attentions on the conservation of the ecosystem, the issue of incidental catches of ecological related species in fishing operations has been of great concerns. This report reviews the interaction between seabirds and Taiwanese longline fisheries and estimated the seabird incidental catch of Taiwan longline fisheries in the Pacific Ocean.

To collect scientific information for target species as well as incidental catch species, Taiwan has launched observer programs since 2002. There were 23 observer trips from 2002 to 2006 on large scale tuna longline vessels operating in the Pacific Ocean. The coverage rate by trips was 3.5% in average. The observed days were 1590.

According to the data collected, the incidental catch was the highest in the areas between 25° -40° N and 165° W to 165° E and areas between 25° -35° S and 165-180W. In comparison, the incidental catch was low in tropical area. The incidental catch rate (BPUE) in each 10*15 degree grid square varied from 0 to 0.65 per 1000 hooks with the average BPUE of 0.045 per 1000 hooks, with variation of species incidentally caught by areas. Black-footed albatrosses and Laysan albatrosses were the major incidental catch species in the northern area. By using the total effort data estimated from logbooks and the seabird BPUE from observers, the preliminary estimated annual seabird incidental catch was around 1700 from 2002 to 2006.

For the conservation of seabirds, including albatross and for the effective implementation of the conservation and management measures adopted by WCPFC, the government required fishermen operating in north of 23N and south of 30 S to mandatory using tori lines since 2007. The observer program was ongoing with one of the main purposes of collecting the seabird incidental catch data.

Keywords: seabird, incidental catch, longline, Pacific Ocean, observer, albatross.

1. INTRODUCTION

There has been increasing global awareness of environmental protection in recent years. The impact of worldwide fishing practices on living marine resources is an issue of major concern to most Regional Fisheries Management Organizations. Among those species, seabird, especially those distributing in high latitude, has drawn much attention from different groups. However, few fishery observer programs are designed to record interactions with seabirds (Gilman. *et al*, 2005). As a result, quantitative information on seabird incidental catch in longline fisheries was from Australian and New Zealand EEZs or from Hawaiian fleets, but scarce from high seas areas (Birdlife International, 2006).

Seabird incidental catch is an important issue and discussed in previous WCPFC scientific meetings. The WCPFC area includes 41% of the global breeding distribution of albatrosses and petrels, with concentration of albatross distribution in area north of 20 N and south of 30S. (BirdLife International, 2007). Earlier estimates of the impact of longline fisheries on adult survival for black-footed albatross and short tail albatross have been given by Véran1 *et al*. 2007 and Okamura. *et al*. 2007. Birdlife international (2006) reported seabird incidental catch rates highly varied ranging from 0 to 0.945 in different longline fisheries. Many researches showed that mitigation measures can be used effectively to significantly reduce seabird incidental catch. The effect of tori line (bird-scaring line) was also discussed in many papers. (Yokota *et al*. 2007; ACAP, 2007.)

As for the seabird conservation measures, WCPFC adopted Resolution 2005-01 on incidental mortality of seabirds requesting CCMs to report their implementation of the IPOA-seabirds and provide all available information on interactions with seabirds, requiring the Commission to consider measures for incidental catch mitigation at its annual meeting in 2006. In 2006, the Conservation and Management Measure 2006-02 to Mitigate the Impact of Fishing for Highly Migratory Fish Stocks on Seabirds was adopted for specific mitigation measures. The CMM requires CCMs to take measures to address seabird incidental catch, which included requiring longline vessels to use at least two of the mitigation measures in area south of 30 degrees south and north of 23 degrees North. It also provided guidelines for implementing those measures. Again, CCMs are encouraged to undertake research to further develop measures to mitigate seabird incidental catch. In 2007, CMM 2007-04 was adopted to amend and replace CMM 2006-02 for providing minimum technical specifications for the mitigation measures.

Taiwan Fisheries Description

The Pacific Ocean is one of the earliest fishing grounds exploited by Taiwanese tuna fishery, with the involvement of three types of fisheries, large scale tuna longline fisheries, small scale tuna longline fisheries, and purse seiners. Currently, Taiwan's large scale longline (LTLL) vessels can be divided into two fleets in accordance with the target species: those operate mainly in tropical area targeting on bigeye tuna, and those operate in subtropical and temperate waters targeting on albacore. Vessels targeting on bigeye tuna usually conduct a year round operation, and transship their catches at sea to carriers and receive fuel and supplies during transshipment.

Most LTLL vessels targeted on albacore for supplying to canneries in Pago Pago in the early stages of development. Before 1995, the catch of albacore in the south region was higher than north region. Constrained by opportunities of fishing agreements for access to waters of the coastal States in the South Pacific, the Taiwanese fishing effort were driven to the North region and drastically increased thereafter. The vessels fish for northern albacore seasonally from September to next March, and shift to the South Pacific fishing for southern albacore from April to August.

In recent years, more vessels targeted on tropical species for Japanese frozen sashimi market. The major fishing grounds of LTLL vessels were located in the central Pacific region, with a total number of 133 vessels operating in 2002 and increased to 142 in 2003. However, owing to the bigeye quota restriction, perceiving of the overcapacity of the fleet, the Fisheries Agency decided to carry out fleet reduction program to reduce the fishing vessels, offering to buyback a large number of LTLL. The number of LTLL decreased to 117 in 2006. During 2002-2006, the dominant species were bigeye, albacore and yellowfin tuna. The average annual catch of bigeye was around 17,300 ton, accounting for about 35% of the total catch, while the average annual albacore tuna was around 16,300 t, accounting for another 33%, and the average annual yellowfin catch was around 8,000 t, accounting around 16%. (Anon. 2007).

Taiwan Observer Program and its concerns for seabird conservation

Noting the importance for fisheries data, the Fisheries Agency of Taiwan has launched an observer program to collect target species and incidental catch data since 2002. The observers were required to collect fisheries activities information, catch data and size measurements on target species and incidental catch species. Biological samples of bigeye, albacore, swordfish and incidental catch/incidental catch species were also collected.

In consistence with the requirement as set forth in the IPOA on Reducing Incidental Catch of Seabirds in Longline Fishery, Taiwan adopted a Seabird NPOA in 2006. It requires fishermen and industries to adopt appropriate measures in accordance with the NPOA. Posters, sheets and booklets for guidance of mitigation measures and species identification for seabirds were disseminated to the fishermen. In addition, after WCPFC adopted CMM 2006-02 on seabirds, in 2007 the Fisheries Agency adopted domestic regulations requiring fishing vessels operating in Pacific use tori lines and other measures to prevent seabird incidental catch.

In response to the provisions as set forth in CMM 2007-04, this study provides the information of seabird incidental catch from the observer programs, and attempts to estimate the seabird incidental catch of Taiwanese large scale longline fleet in the Pacific Ocean from 2002 to 2006.

2. METHODS

Data collected

Two sources of data have been used in this study. The key data came from the scientific observers on board longline vessels between 2002 and 2006. During the deployment, scientific observers took note of the fishing activities. In addition, they recorded the information of incidental catch, including seabirds, sea turtles and sharks. The information included fishing method (e.g. position, number of hooks, time of set and position, catch number and weight), as well as seabird information (sighting, incidental catch Identification cards and training programs were developed for the observers to record the situation of seabird. During the five years, data were collected by observers from 23 trips.

Another source was the fishing effort data estimated from logbooks between 2002 and 2006. The effort data were derived from logbooks collected by the Fisheries Agency which were submitted by vessel captains. Since the logbook coverage was less than 100%, the effort data would be raised based on the total catch data. The effort data were calculated by 5*5 degree grid square by month.

Stratification

The incidental catch rate of seabird will be affected by the seabird spatial and temporal distribution. In addition, the observer coverage was lower in the early stage of implementation of the observer program, and there were even some areas without observations. So we assume there was no significant variance in catch rates between years and combined the five years data together. For better estimation and higher coverage, we were using the following stratification.

For the temporal factor, we separated the time into four period, the Season 1(January - March), Season 2(April - June), Season 3(July-September) and Season 4(October-December).

For the spatial stratification, the original raw data were separated by 5*5 degrees. However, if we used 5*5 degree as the stratification, some grids appeared to be without any observations. Considering the observer's coverage areas and the distribution of seabirds, we stratified the area to 10*15 degree as shown in Figure 1. Then there would be as least two to five 5*5 grids with observation in most 10*15 sub-areas.

Estimation of seabird mortality

The incidental catch rate was computed by the numbers of birds caught per 1000 hooks.

BPUE(c)= # of incidental catch /thousand hooks.

The following formulae were used to estimated the annual seabird incidental catch,

$$C = \sum_{j=1}^4 \sum_{i=1}^n c_{ij} * A_{ij}$$

C: estimated the annual seabird incidental catch,

c_{ij} : observed BPUE within area i in season j,

A: Number of 1000 hooks deployed in area i, season j,

i: area, which were defined as the 10*15 degree square as showed in Figure 1.

j: season, which were defined as Season 1(January - March), Season 2(April - June), Season 3(July-September)and Season 4(October-December) .

The observer recorded the number of seabird incidental catch and hooks for each hauls. The BPUE of 1590

hauls were used to estimate the mean and variance in each 10*15 grids and each seasons. There would be a BPUE dataset for each season and each 10*15 grid. The effort data (thousand hooks) estimated from logbook from 2002 to 2006 multiple the BPUE by seasons and by areas to get the number of incidental catch. Then the incidental catch numbers were summarized by years.

3. Results

Longline Fisheries Activities

The annual fishing effort varied from 82,978 to 145,106 thousand hooks between 2002 and 2006 in Pacific Ocean, with an average of 118,206 thousand hooks. The geographical distributions of fishing effort are shown in Figure 2. There were three major fishing grounds: the bigeye tuna fleet in tropical areas between 175 E – 110 W, 10 N to 20 S; the northern albacore fleet in 140 W -170W, 25N-45N and the south albacore fleet in 150 W -110W, 10N-45N.

The effort by areas was shown in Figure 3. The effort of bigeye fleet in tropical areas (15N-15S) was stable during the year. The effort of albacore fleets was not uniform. Hooks set in south areas (South of 15 S) were concentrated in Season 2 and Season 3. The hooks set in north area (North of 15N) were majorly in Season 1 and Season 4.

Observation data

The total observer's trips were 23 between 2002 and 2006, 15 trips for bigeye fishing vessels and 8 trips for albacore vessels. Over 60% of the observers were deployed on bigeye vessels since it's the major fisheries. The observer coverage increased from 0.75% in 2002 to 8.55% in 2006, with the average coverage rate of 3.5%.

The total observations were 1,590 days and 5,348 thousands hooks from 2002 to 2006. Over 60% of the observation area was in the tropical areas, with only 33% in north area and the remaining in south area (Figure 4).

Seabird Sighted

During the observed trips (2002 to 2006), seabirds were sighted in 698 days, accounting for 43.9% of the total observed days. The sighting rate was 86.2% of all observation days in north area, 25.5 % in tropical area and 45.5 % in south area. It showed the sighting rate was highest in north area. In other words, higher possibility of incidental catch of seabird occurs in north area. The major seabird species sighted were included in Table1 and Figure 5.

Seabird Incidental Catch Rate

The incidental catch rate of seabird by 10*15 degree grid was shown in Figure 6. The seabird incidental catch BPUE varied from 0 to 0.65 per 1000 hooks, with the average BPUE of 0.045 per 1000 hooks. It showed the seabird incidental catch rate was the highest in area north of 30 N, especially in areas between 160W-160E, 30-45N. The BPUE was lower in tropical area and only in limited areas.

As for the incidental catch season factor, the seasonal BPUE were shown in Figure 7. Higher incidental catch rate occurred in season 1 and season 4 in north area and lower incidental catch rate in season 2 and season 3 in south area.

Incidental Catch Species by Area

Three area where incidental catch occurred were identified: the north area, tropical area, south east area and south west area. Our observers program is designed for collecting information on tuna and tuna-like species, and some observers did not have the ability to correctly identify the seabird species especially the dead seabirds on hooks. Meanwhile, the seabird species identification did not start until 2004. The data collected before 2004 were without species information. Although the species identification information was limited, some species

information was still provided by the observers as shown in Table 2. The major bycatch species in north area were black footed albatross and Laysan albatross. Frigatebird was bycaught in tropical area. And in south area, the Buller's albatross, southern giant petrel and white-chinned petrel were recorded.

Estimated total Seabird Incidental catch

The BPUE and the effort data were used to estimate the seabird incidental catch. The preliminary estimated annual seabird incidental catches ranged from 544 in 2002 to 2628 in 2005, with the average of 1660 per year. The average seabird incidental catch, fishing effort and estimated seabird incidental catch mortality by 15 degree latitude were shown in Figure 8. It shows the seabird incidental catch occurred more in higher latitudes in the north, especially in area north of 30 degrees north. In terms of fishing effort distribution, seabird incidental catches were relatively low in tropical areas.

4. DISCUSSION

The method was the first time used to estimate the annual seabird incidental catch mortality in Pacific Ocean. Because of the low observer coverage in the early years, we combined five years observers' data, trying to cover more fishing grounds of Taiwanese fishing vessels. Even though, variances between years occurred. Therefore, this analysis should be considered as a start point, but not a final result. Other methods could be used to estimate the seabird incidental catch levels and they would be tested in the future.

Seabird abundance and species composition is not uniform throughout the region. In this study, there were significant differences in BPUE between areas. The BPUE was higher in temperate areas than in tropical areas. Data in 5*5 degree grid square could clearly show the variation. WCPFC Convention Area covers some 40% of the global breeding distribution of the 23 species of albatross and petrel (WCPFC-SC3-EB SWG/IP-17). Through this study, we could identify some hot spots area for seabird conservation.

The probability of catching seabirds may depend on fishing area, bait, fishing gears, the seabird behavior. The further analysis on the characteristics of fishing activities and seabird ecology would be useful to obtain more information for seabird incidental catch estimation, further reducing the seabird incidental catch.

Noting the importance of ecosystem approach conservation and management, our government has already adopted the National Plan of Action on Seabird. There is a need to increase the observer deployment on fishing vessels operating in the northern areas for collecting seabird incidental catch information and encouraging the vessels operating in high latitude to set the bird scaring line to avoid seabird incidental catch.

REFERENCE

- ACAP. 2007. Seabird Bycatch Mitigation: Minimum Standards for Pelagic Longline Fishing and Priorities for Further Research. WCPFC-SC3-EB SWG/WP-14
- Anonymous. 2007. National Report-Tuna Fisheries Status Report of Chinese Taipei in the Western and Central Pacific Region.
- Birdlife International. 2006. Summary Of Seabird Bycatch Rates Recorded In The Western And Central Pacific Paper Submitted To The Second Session Of The WCPFC Ecosystem And Bycatch SWG Manila, 10th August 2006
- Birdlife International, 2007, Distribution of Albatrosses and Petrels In The WCPFC Convention Area And Overlap With WCPFC Longline Fishing Effort, WCPFC-SC3-EB SWG/IP-17
- Gilman, E., Brothers, N. and Kobayashi, D. 2005. Principles and Approaches to Abate Seabird By-Catch in Longline Fisheries. Fish and Fisheries 6: 35-49.
- Kosuke Yokota, Hiroshi Minami And Masashi Kiyota. 2007. Effective Factors of Tori-Poles In Reducing Incidental Catch Of Seabirds In The Japanese Longline Fishery, WCPFC-SC3-EB SWG/WP-13
- Okamura, H. M. Kiyota1, H. Kurota1, and T. Kitakado. 2007. Estimation of Fisheries Bycatch And Risk

Assessment For Short-Tailed Albatross Using A Bayesian State-Space Model, WCPFC-SC3-EB SWG/IP-18.

Sophie Veran, O. Gimenez, E. Flint, W. L. Kendall, P. F. Doherty and J-D Lebreton.2007.Quantifying The Impact Of Longline Fisheries On Adult Survival In The Black-Footed Albatross. Journal of Applied Ecology. doi: 10.1111/j.1365-2664.2007.01346.x

Table 1 Seabirds species sighted in Pacific Ocean by areas.

Area	Sighted seabird species
North	Black-footed albatross, Laysan albatross, Giant petrel, unidentified albatrosses, unidentified sea birds
Tropical	Frigatebird, unidentified sea birds
South	Southern Giant Petrel, unidentified albatross, unidentified sea birds

Table 2 the incidental catch species by area.

Area	Seabird Species
North	Black footed albatross, Laysan albatross, unidentified albatross.
Tropical	Frigatebird, Other seabirds
South	Buller's albatross, Southern giant petrel, White-chinned petrel

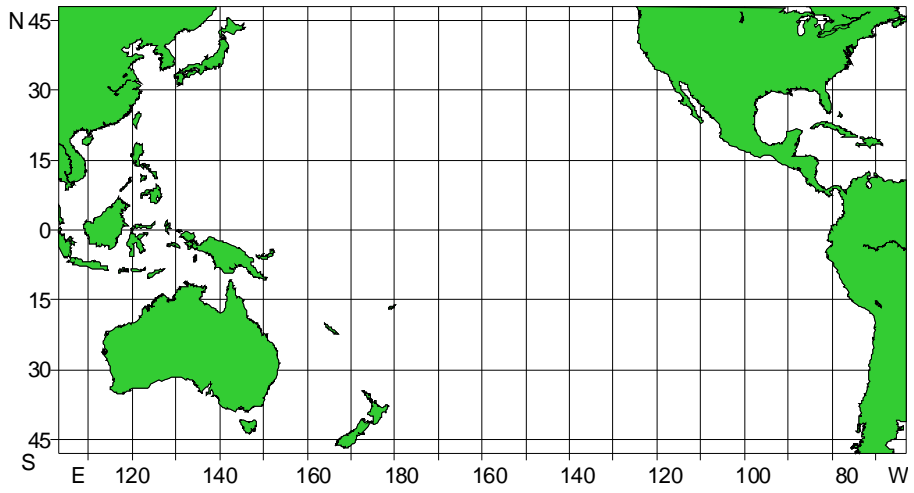


Figure 1 Spatial stratification for estimation the sea birds mortality

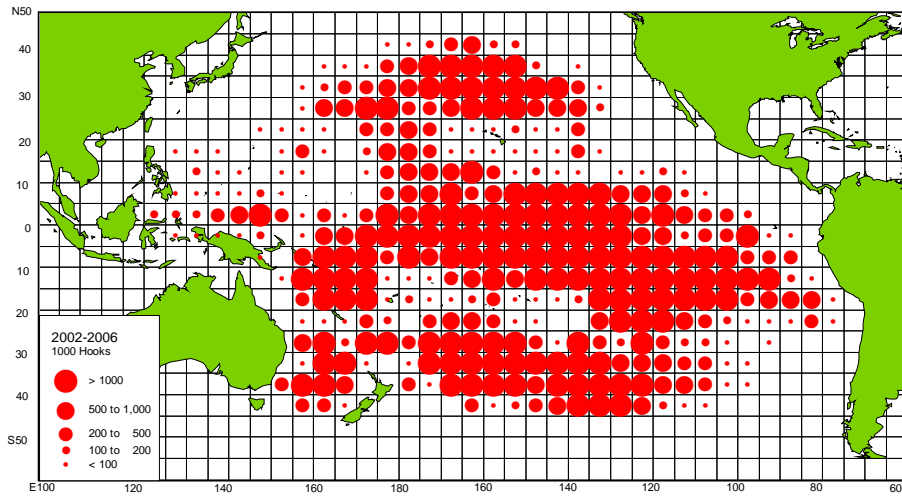


Figure 2 Distribution of efforts of Taiwanese longline fisheries in the Pacific Ocean between 2002 and 2006

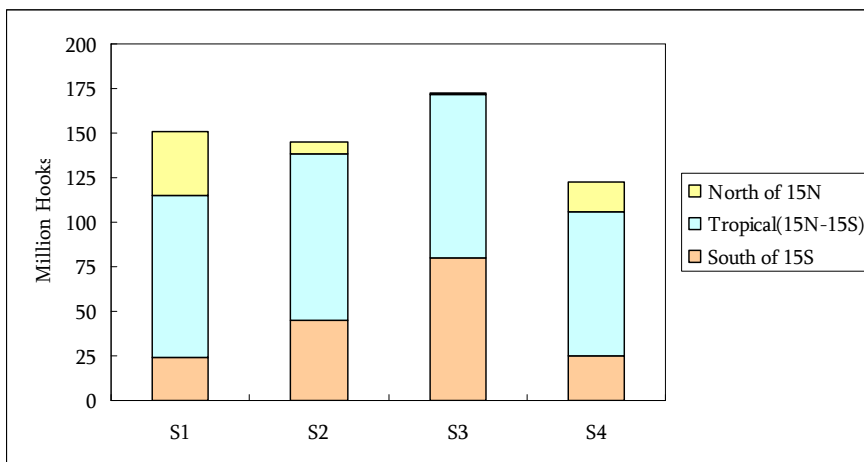


Figure 3 Efforts deployed by season by area from 2002 to 2006

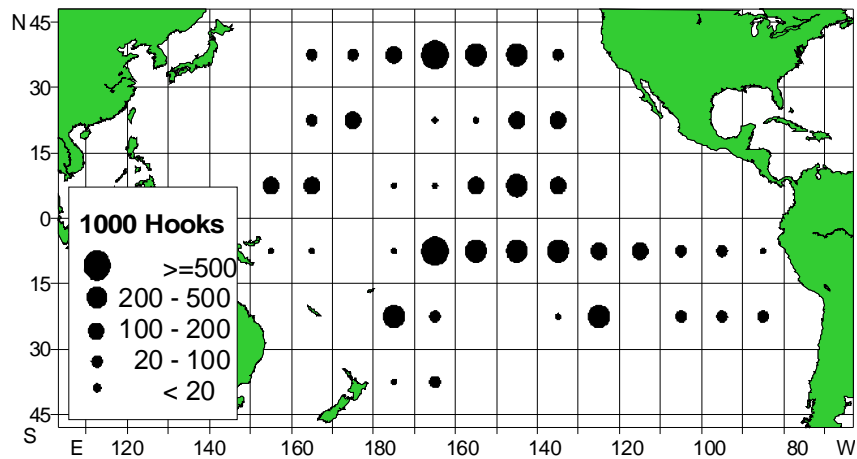


Figure 4 Distribution of observed fishing efforts from 2002 to 2006

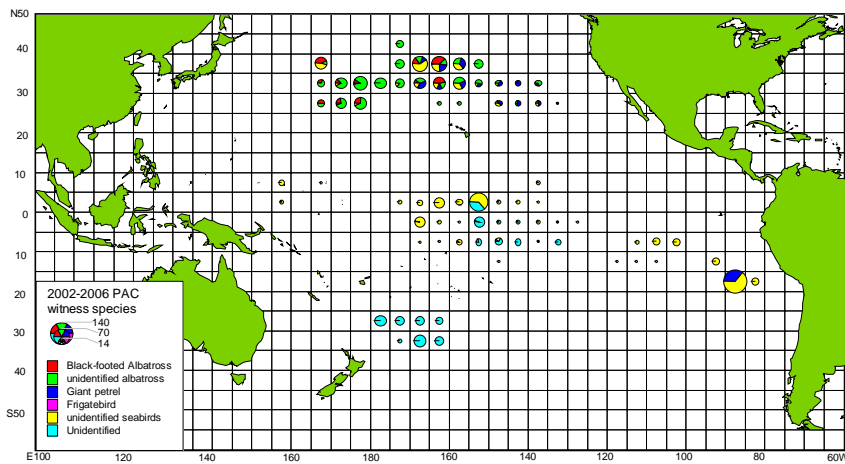


Figure 5 The seabirds sighted by species from 2002 to 2006

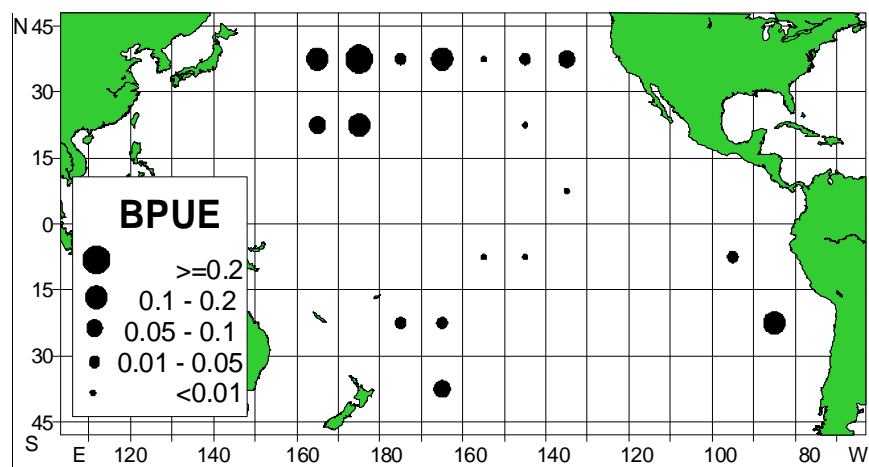


Figure 6 Distribution of seabird BPUE(numbers per thousand hooks) from 2002 to 2006

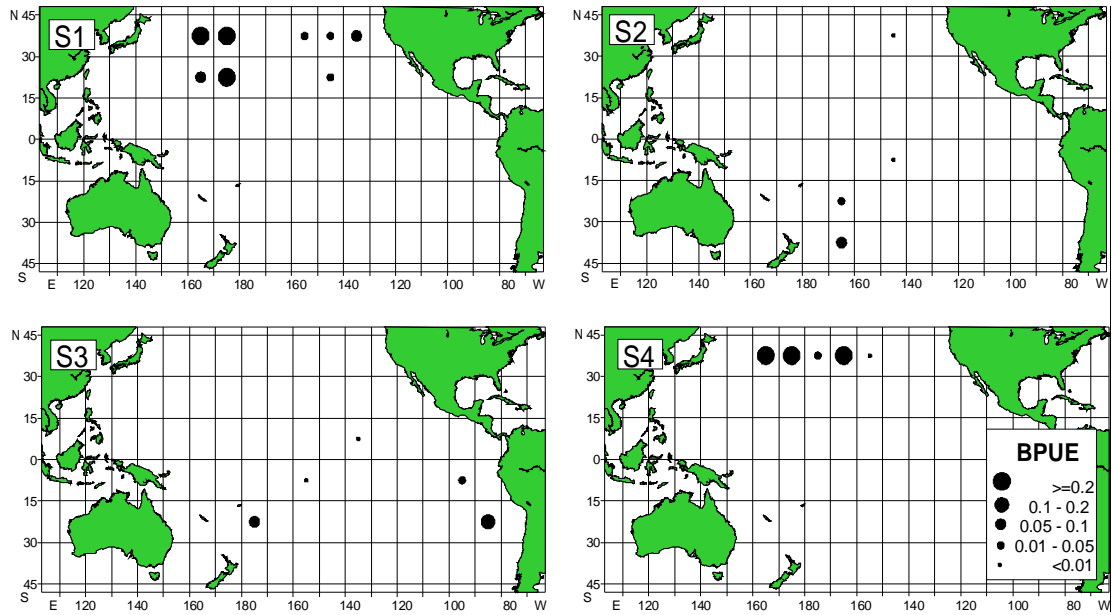


Figure 7 Distribution of seabird BPUE (numbers per thousand hooks) by seasons from 2002 to 2006

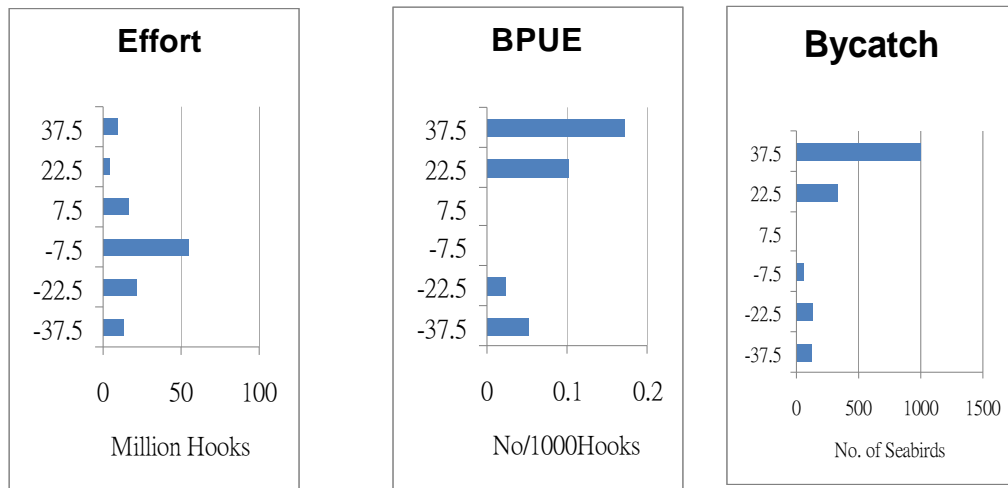


Figure 8 Fishing efforts, seabird BPUE, and estimated seabird incidental catch number by Latitude from 2002 to 2006.