

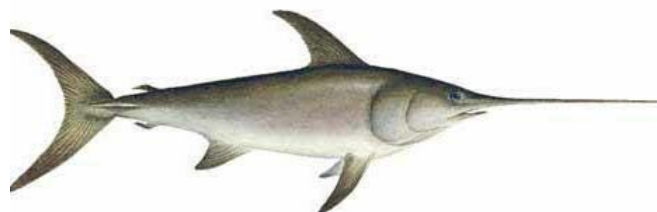
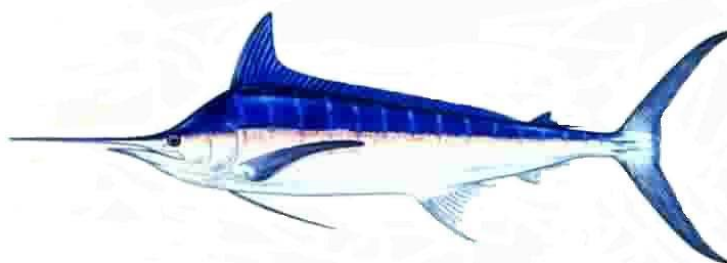


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Input data for a North Pacific Swordfish Stock Assessment using Bayesian Production Models

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Abstract

Input data were compiled collaboratively by ISC Billfish Working Group (WG) scientists for a North Pacific swordfish stock assessment. The WG recommended two stock structure scenarios for swordfish stock assessment in the North Pacific: 1) a single North Pacific stock north of the equator, and 2) a two-stock scenario with a diagonal boundary from Baja, California (25°N x 110°W) to approximately 170°W at the equator. The WG also recommended two stock assessment modeling approaches: Bayesian production and Stock Synthesis. This report summarizes input data for Bayesian production models. Catch and catch per unit effort (CPUE) were compiled annually under the two stock structure scenarios. Correlations of annual standardized CPUE by stock scenario are presented. Additional input data for Stock Synthesis models are described separately.

Introduction

Input data were compiled collaboratively by ISC Billfish Working Group (WG) scientists for a North Pacific swordfish stock assessment using Bayesian production models and Stock Synthesis. This report summarizes input data for Bayesian production models. Catch and catch per unit effort (CPUE) were compiled annually under the two stock structure scenarios. Correlations of annual standardized CPUE by stock scenario are presented. Additional input data for Stock Synthesis models are presented separately.

Methods

Stock Structure Scenarios

The WG recommended two stock structure scenarios be considered for swordfish stock assessment in the North Pacific (BILL-WG 2008, BILL-WG 2009). Stock Scenario-1 is a single North Pacific stock north of the equator (Figure 1). Stock Scenario-2 is a two-stock scenario with a diagonal boundary from Baja, California (25°N x 110°W) to approximately 170°W at the equator (Figure 2). The boundary for Stock Scenario-2 followed a stair step pattern modified from Ichinokawa and Brodziak (2008). The southern boundary of Stock Scenario-2 in the Western and Central Pacific Ocean is at the equator and in the EPO the southern limit is set at 20°S (Figure 2).

Catch (mt)

North Pacific swordfish catch (mt) 1951 – 2006 was compiled by country and gear type for each stock scenario. Catch data were not available prior to 1951 and catch data were incomplete after 2006.

Japanese offshore and distant-water longline catch (mt) 1951 – 2007 was compiled quarterly for each stock scenario in Kimoto and Yokawa (2009a Figures 1 and 2). Additional Japanese catch (mt) 1951 – 2006 (including Japanese offshore and distant-water longline catch, coastal longline, other longline, squid drift net, drift net, bait fishing, net fishing, trap net, and others-primarily harpoon) was provided separately by stock scenario, sub-area, and quarter (Kimoto and Yokawa 2009c).

Chinese Taipei distant water longline catch (in numbers) 1995 – 2007 was provided by stock scenario, sub-area, and year. For Stock Scenario-1, other Chinese Taipei catch (mt) 1959 – 2005 (including distant water longline, offshore longline, offshore gillnet, offshore others, coastal harpoon, coastal set net, coastal gillnet and other net, coastal longline, coastal others, and other) were taken directly from the category 1 catch table. For Stock Scenario-2, the ratio of catch in numbers was used to apportion distant water longline catch (mt) from the category 1 catch table to Sub-Area 1 and Sub Area-2 for the years 1995-2007. All other Chinese Taipei catch 1959 – 1994 was assumed to occur entirely in Sub-Area 1. Chinese Taipei catch (mt) data were not updated for 2006.

Korea catch was included in the assessment but catch data were not provided separately by stock scenario. For Stock Scenario-1, Korea catch (mt) 1971 – 2006 was taken directly from the category 1 catch table. For Stock Scenario-2, Korea longline catch was apportioned to Sub Area-1 and to Sub Area-2 based on following criteria. In recent years (1990-2004), Korea longline catch accounted for almost 5% of the swordfish catch in the EPO (Appendix A). However, the proportions of Korea longline catch within Sub Area-1 and Sub Area-2 were not available. To account for the fact that Korea longline catch occurred in the EPO, and that no other information was available, Korea longline catch was apportioned 50% to each sub-area. Korea catch locations were not compared explicitly to the putative stock boundary.

Mexico catch was included in the assessment, but catch data were not provided separately by stock scenario. For Stock Scenario-1, Mexico catch (mt) 1972 – 2006 was taken directly from the category 1 catch table. For Stock-Scenario 2, Mexico catch was apportioned 100 % to Sub Area-2 based on the following criteria. Category 1 catch data for Mexico were updated for this assessment in Fleischer et al. (2009). During the years 1999-2000 the main swordfish fishing grounds for Mexico were primarily within Sub Area-2 off of Baja California between longitude 20 °N and 30 °N (Fleischer et al. 2009, Figure 6). An assumption is that fishing patterns during the years 1999-2000 were similar to other years with reported Mexico catch. Mexico catch locations were not compared explicitly to the putative stock boundary.

Hawaii catch was included in the assessment, but catch data were not provided separately by stock scenario. For Stock Scenario-1, Hawaii longline catch (mt) 1970 – 2006 was taken directly from the category 1 catch table. For Stock-Scenario 2, Hawaii catch was apportioned 100 % to Sub-Area 1 based on the following criteria. An examination of Hawaii longline catch by Latitude and Longitude showed that swordfish catch in the Hawaii-based pelagic longline fishery, 1995-2007, occurred primarily in Sub-Area 1 (Appendix B) (Also see Ito and Childers 2008).

California catch was included in the assessment, but catch data were not provided separately by stock scenario. For Stock Scenario-1, California catch (mt) 1970 – 2006 was taken directly from the category 1 catch table. For Stock-Scenario 2, California catch was apportioned 100 % to Sub Area-1 based on the following criteria. California catch began in the 1970s and it was assumed that Mexico had excluded US fisheries from its EEZ by the 1970s. Additionally the driftnet fishery occurred almost exclusively off the California coast (Piner and Betcher 2009a, Figure 1) (Also see Ito and Childers 2008). California catch locations were not compared explicitly with the putative stock separation boundary.

Spanish catch data were not included in this assessment. In recent years (1990-2004), Spanish catch accounted for 20% of the swordfish catch in the EPO (Appendix A). However, Spanish catch (mt) within the sub areas identified for this stock assessment were not available. Operations of the Spanish longline fishery targeting swordfish in the Pacific are summarized in Mejuto et al. (2001, 2005, 2007). During the years 1998 and 1999, the Spanish longline fishery targeting swordfish in the Pacific had limited longline fishing effort (< 100,000 hooks per 5°x5° square) north of the equator in the eastern Tropical Pacific (Mejuto et al. 2007 Figure 10). During the year 2005, the Spanish longline fishery targeting swordfish in the Pacific had limited longline fishing effort (< 100,000 hooks per 5°x5° square) north of the 20 ° North Latitude in the Western Pacific (Mejuto et al. 2007 Figure 11). During many years between 1990 – 2005, the southern boundary of Sub Area 2 for this stock assessment (20°S Latitude) bisected the northern edge of Spanish longline fishing effort (> 100,000 hooks per 5°x5° square) in the Southeast Pacific (Mejuto et al. 2007 Figures 10 and 11).

Chilean catch data were not included in this assessment. In recent years (1990-2004), Chilean catch accounted for 30% of the swordfish catch in the EPO (Appendix A). However, Chilean catch within sub-areas identified for this assessment were not available.

Standardized CPUE

Standardized estimates of north Pacific swordfish catch per unit effort (CPUE) along with estimates of precision were compiled by country and gear type separately for each stock scenario for the years 1952 – 2008. However, only CPUE for the years 1952 – 2006 were used in stock assessment to match the available catch data.

Standardized CPUE (n/1,000 hooks) from Japanese offshore and distant-water longline (1952 – 2007) was estimated using general linear models (GLM) (Kimoto and Yokawa 2009b Figure 10). Annual estimates of CPUE and standard error (SE) were obtained from model fits in Kimoto and Yokawa (2009b). SE was approximated here as 1.96*SE based on the 95% confidence intervals provided in Kimoto and Yokawa (2009b) (Also see Ishimura et al. 2008).

Standardized CPUE (n/1,000 hooks) from Chinese Taipei distant water longline (1995 – 2007) was estimated using GLM analysis (Sun et al. 2009, Figure 4). Annual estimates of CPUE and SE were obtained from model fits (Sun et al. 2009) (Also see Sun and Yeh 2008, and Yeh and Sun 2008).

Standardized CPUE (n/1,000 hooks) from Hawaii (USA) based pelagic longline (1995 – 2007) was estimated separately for shallow-sets and deep-sets with generalized additive model (GAM) analysis (Courtney et al 2009b). Hawaii longline standardized CPUE was not estimated separately by stock scenario. Instead, for Stock-Scenario 2, Hawaii longline standardized CPUE was apportioned 100 % to Sub-Area 1 based on the following criteria. Swordfish catch in the Hawaii-based pelagic longline fishery, 1995-2007, occurred primarily in Sub-Area 1 (Appendix B). Annual estimates of CPUE were obtained from GAM predicted catch as

$$\hat{R} = \frac{\text{total number of swordfish predicted}}{\text{total number of hooks}} = \frac{\sum_1^n y_i}{\sum_1^n x_i},$$

where i is the number of sets from observed and unobserved trips combined. Annual estimates of SE were estimated from the ratio estimator following Chochran (1977; eq. 2.47)

$$s(\hat{R}) \cong \frac{1}{\sqrt{n\bar{x}}} \sqrt{\frac{\sum_1^n (y_i - \hat{R}x_i)^2}{n-1}} = \frac{1}{\sqrt{n\bar{x}}} \sqrt{\frac{\sum_1^n y_i^2 - 2\hat{R}\sum_1^n y_i x_i + \hat{R}^2 \sum_1^n x_i^2}{n-1}}.$$

For model input, Hawaii longline SE was transformed to a weighted average CV of 20%, comparable to the other longline CPUE series. Standardized CPUE from Hawaii deep-sets was considered preliminary data and was not included in the final Bayesian Production model runs.

Standardized CPUE (n / fathom hr) from California driftnet fisheries was estimated annually with GLM analysis (Piner and Betcher 2009a). Coefficient of variation (CV) was obtained by jackknifing the data (Piner and Betcher 2009a). For model input, SE was estimated here as CV*CPUE and the units were transformed to n/1,000 fmhrs in order to match the scale of other CPUE time series. California driftnet standardized CPUE was not estimated separately by stock scenario. Instead, for Stock-Scenario 2, California driftnet standardized CPUE was apportioned 100 % to Sub-Area 1 based on the following criteria. California catch began in the 1970s and it was assumed that Mexico had excluded US fisheries from its EEZ by the 1970s. Additionally the driftnet fishery occurred almost entirely off of the California coast (Piner and Betcher 2009a).

Figure 1). California catch locations were not compared explicitly with the putative stock separation boundary 9 (Also see Ito and Childers 2008). Standardized CPUE from California driftnet fisheries was considered preliminary data and was not included in the final Bayesian Production model runs. An updated CPUE time series from the California driftnet fisheries was also provided (Piner and Betcher 2009b).

Correlations of Standardized CPUE

Standardized estimates of north Pacific swordfish CPUE were compared with correlation analysis by country and gear type for each stock scenario. Standardized estimates of north Pacific swordfish CPUE were also compared among Sub-Areas for Stock Scenario-2. In each case, P-values were obtained from two tailed t-tests with n-2 degrees of freedom and critical values t_s following Sokal and Rohlf (1995, p. 575)

$$H_0 : \rho = 0 \text{ versus } H_a : \rho \neq 0 \quad t_s = r \sqrt{\frac{n-2}{1-r^2}}.$$

Results

North Pacific swordfish catch data (mt) 1951 – 2006 were compiled annually by country and gear type separately for each stock scenario (Tables 1 – 3, Figures 3 and 4).

Standardized estimates of north Pacific swordfish catch per unit effort (CPUE) along with estimates of precision were compiled annually (1952 – 2008) by country and gear type separately for each stock scenario (Tables 4 – 6; Figures 5 and 6).

Correlation analyses of CPUE were compiled by country and gear type for each stock scenario (Tables 7 and 8, Figure 7).

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Catch (mt) Stock Scenario -1		Japan										Chinese Taipei ⁽¹⁾		Korea	Mexico	US Hawaii	US California			Grand Total
		Coastal+Offshore		All Other Gears		Distant Water	All Other Gears		All Gears	All Gears	Longline	Longline ⁽²⁾	Gillnet	Other Gear+Unknown						
Year																				
1951		7246		4432	-	-	-	-	-	-	-	-	-	-	-	-	-	11,678		
1952		8890		2801	-	-	-	-	-	-	-	-	-	-	-	-	-	11,691		
1953		10796		1612	-	-	-	-	-	-	-	-	-	-	-	-	-	12,408		
1954		12563		1047	-	-	-	-	-	-	-	-	-	-	-	-	-	13,611		
1955		13064		1047	-	-	-	-	-	-	-	-	-	-	-	-	-	14,111		
1956		14596		890	-	-	-	-	-	-	-	-	-	-	-	-	-	15,485		
1957		14268		983	-	-	-	-	-	-	-	-	-	-	-	-	-	15,251		
1958		18525		1209	-	-	-	-	-	-	-	-	-	-	-	-	-	19,734		
1959		17236		1031	-	-	518	-	-	-	-	-	-	-	-	-	-	18,786		
1960		20058		1342	-	-	647	-	-	-	-	-	-	-	-	-	-	22,047		
1961		19715		1432	-	-	391	-	-	-	-	-	-	-	-	-	-	21,538		
1962		10607		1508	-	-	556	-	-	-	-	-	-	-	-	-	-	12,671		
1963		10322		922	-	-	361	-	-	-	-	-	-	-	-	-	-	11,604		
1964		7669		1183	-	-	368	-	-	-	-	-	-	-	-	-	-	9,220		
1965		8742		2249	-	-	358	-	-	-	-	-	-	-	-	-	-	11,349		
1966		9866		1897	-	-	520	-	-	-	-	-	-	-	-	-	-	12,283		
1967		10883		1125	-	-	681	-	-	-	-	-	-	-	-	-	-	12,689		
1968		9810		1839	-	-	775	-	-	-	-	-	-	-	-	-	-	12,424		
1969		9416		1920	-	0	850	-	-	-	-	-	-	-	-	-	-	12,186		
1970		7324		2223	-	-	909	-	-	-	5	-	-	-	-	-	622	11,083		
1971		7037		909	-	-	995	0	-	-	1	-	-	-	-	-	102	9,044		
1972		6796		891	-	-	873	0	2	0	0	-	-	-	-	-	175	8,737		
1973		7123		1307	-	-	979	0	4	0	0	-	-	-	-	-	403	9,816		
1974		5983		2193	-	1	1,016	0	6	0	0	-	-	-	-	-	428	9,627		
1975		7031		3575	-	29	1,052	0	-	0	0	-	-	-	-	-	570	12,257		
1976		8054		4747	-	23	807	0	-	0	0	-	-	-	-	-	55	13,686		
1977		8383		3505	-	36	683	219	-	17	0	-	-	-	-	-	337	13,180		
1978		8001		3769	-	-	558	68	-	9	-	-	-	-	-	-	1,712	14,117		
1979		8602		2246	-	7	694	-	7	7	-	-	-	-	-	-	386	11,949		
1980		6005		3038	-	10	679	64	380	5	-	160	-	-	-	-	628	10,969		
1981		7039		2774	-	2	681	-	1,575	3	0	473	-	-	-	-	273	12,820		
1982		6064		2392	-	1	904	48	1,365	5										

- 1) Catch in 2006 has not been updated.
- 2) Grey indicate a limited number of longline vessels operated and catch was combined with Hawaii longline.
- 3) Japanese catch in 2005 and 2006 is provisional.

Table 2. Stock Scenario-2 (Sub Area-1) swordfish catches (mt) by fisheries, 1951-2006;
 “-” indicates no effort or data not available, and “0” indicates less than 1 metric ton.

Catch (mt) Stock Scenario-2 (Sub Area-1)										
Year	Japan		Chinese Taipei ¹⁾		Korea	Mexico	US Hawaii	US California		
	Coastal+Offshore	All Other Gears	Distant Water	All Other Gears	All Gears	All Gears	Longline	Longline ²⁾	Gillnet	Other Gear+Unknown
1951	7,245	4,432	-	-	-	-	-	-	-	-
1952	8,889	2,801	-	-	-	-	-	-	-	-
1953	10,794	1,612	-	-	-	-	-	-	-	-
1954	12,548	1,047	-	-	-	-	-	-	-	-
1955	13,054	1,047	-	-	-	-	-	-	-	-
1956	14,588	890	-	-	-	-	-	-	-	-
1957	14,162	983	-	-	-	-	-	-	-	-
1958	18,453	1,209	-	-	-	-	-	-	-	-
1959	17,169	1,031	-	-	518	-	-	-	-	-
1960	19,961	1,342	-	-	647	-	-	-	-	-
1961	19,272	1,432	-	-	391	-	-	-	-	-
1962	9,838	1,508	-	-	556	-	-	-	-	-
1963	9,016	922	-	-	361	-	-	-	-	-
1964	6,272	1,183	-	-	368	-	-	-	-	-
1965	7,934	2,249	-	-	358	-	-	-	-	-
1966	8,751	1,897	-	-	520	-	-	-	-	-
1967	9,940	1,125	-	-	681	-	-	-	-	-
1968	8,564	1,839	-	-	775	-	-	-	-	-
1969	5,929	1,920	-	0	850	-	-	-	-	-
1970	4,956	2,223	-	-	909	-	5	-	-	622
1971	5,781	909	-	-	995	0	1	-	-	102
1972	5,326	891	-	-	873	0	0	-	-	175
1973	4,703	1,307	-	-	979	0	0	-	-	403
1974	4,630	2,193	-	1	1,016	0	0	-	-	428
1975	5,541	3,575	-	29	1,052	0	0	-	-	570
1976	6,154	4,747	-	23	807	0	0	-	-	55
1977	6,314	3,505	-	36	683	110	17	-	-	337
1978	6,220	3,769	-	-	558	34	9	-	-	1,712
1979	7,142	2,246	-	7	694	-	7	-	-	386
1980	4,414	3,038	-	10	679	32	5	-	160	628
1981	5,628	2,774	-	2	681	-	3	0	473	273
1982	4,968	2,392	-	1	904	24	5	0	945	166
1983	6,399	2,239	-	0	949	6	5	0	1,693	65
1984	6,350	2,458	-	-	997	24	3	12	2,647	179
1985	8,377	2,402	-	-	825	12	2	0	2,990	409
1986	7,213	2,480	-	-	667	5	2	0	2,069	400
1987	7,638	2,054	-	3	1,518	22	24	0	1,529	266
1988	6,717	2,112	-	-	1,040	14	24	0	1,376	262
1989	5,003	2,741	-	50	1,529	20	218	0	1,243	118
1990	3,902	1,909	-	143	1,463	31	2,436	0	1,131	107
1991	2,942	1,483	-	40	1,570	3	4,508	27	944	64
1992	4,705	2,471	-	21	1,716	4	5,700	62	1,356	122
1993	6,189	2,043	-	54	1,484	8	5,909	27	1,412	329
1994	5,427	2,127	-	-	1,374	33	3,176	631	792	181
1995	4,752	2,412	-	49	1,360	5	2,713	268	771	126
1996	5,181	2,141	-	5	732	8	2,502	346	761	96
1997	4,860	1,992	-	12	1,419	50	2,881	512	708	95
1998	4,081	2,207	-	5	1,219	77	3,263	418	931	67
1999	4,298	2,241	-	36	1,446	66	3,100	1,229	606	108
2000	4,509	2,480	-	112	1,617	101	2,949	1,885	646	99
2001	4,032	1,915	-	61	1,782	219	220	1,749	375	57
2002	4,037	2,370	-	88	1,584	220	204	1,320	302	93
2003	3,478	2,442	-	100	2,207	191	147	1,812	216	107
2004	3,949	2,834	-	176	1,844	205	213	898	169	99
2005 ³⁾	4,192	2,777	-	109	1,839	217	1,475	-	220	76
2006 ³⁾	5,108	2,893	-	-	239	-	1,175	-	444	73

1) Catch in 2006 has not been updated.

2) Grey indicate a limited number of longline vessels operated and catch was combined with Hawaii longline.

3) Japanese catch in 2005 and 2006 is provisional.

Table 3. Stock Scenario-2 (Sub Area-2) swordfish catches (mt) by fisheries, 1951-2006; Blank indicates no effort, “-” indicates data not available, and “0” indicates less than 1 metric ton.

Stock Scenario-2 (Sub Area-2)											
Year	Japan		Chinese Taipei ¹⁾		Korea	Mexico	US Hawaii	US California			Grand Total
	Coastal+Offshore	All Other Gears	Distant Water	All Other Gears	All Gears	All Gears	Longline	Longline ²⁾	Gillnet	Other Gear+Unknown	
1951	1		-		-	-					1
1952	1		-		-	-					1
1953	2		-		-	-					2
1954	15		-		-	-					15
1955	10		-		-	-					10
1956	8		-		-	-					8
1957	106		-		-	-					106
1958	71		-		-	-					71
1959	68		-		-	-					68
1960	97		-		-	-					97
1961	443		-		-	-					443
1962	768		-		-	-					768
1963	1,306		-		-	-					1,306
1964	1,397		-		-	-					1,397
1965	807		-		-	-					807
1966	1,115		-		-	-					1,115
1967	943		-		-	-					943
1968	1,246		-		-	-					1,246
1969	3,487		-		-	-					3,487
1970	2,368		-		-	-					2,368
1971	1,257		-		0	-					1,257
1972	1,470		-		0	2					1,472
1973	2,420		-		0	4					2,424
1974	1,353		-		0	6					1,359
1975	1,491		-		0	-					1,491
1976	1,900		-		0	-					1,900
1977	2,069		-		110	-					2,178
1978	1,781		-		34	-					1,815
1979	1,459		-		-	7					1,466
1980	1,592		-		32	380					2,004
1981	1,410		-		-	1,575					2,985
1982	1,097		-		24	1,365					2,486
1983	1,294		-		6	120					1,419
1984	826		-		24	47					897
1985	958		-		12	18					988
1986	1,508		-		5	422					1,934
1987	1,857		-		22	550					2,429
1988	1,857		-		14	613					2,484
1989	1,687		-		20	690					2,397
1990	1,931		-		31	2,650					4,611
1991	1,868		-		3	861					2,731
1992	2,530		-		4	1,160					3,694
1993	2,110		-		8	812					2,929
1994	1,939		-		33	581					2,553
1995	1,670			1	5	437					2,114
1996	1,735			4	8	439					2,186
1997	2,143			3	50	2,365					4,561
1998	2,153			15	77	3,603					5,847
1999	1,260			34	66	1,136					2,495
2000	1,671			213	101	2,216					4,201
2001	2,900			978	219	780					4,877
2002	2,193			1,545	220	465					4,423
2003	1,897			984	191	671					3,742
2004	1,446			708	205	270					2,629
2005 ³⁾	1,168			328	217	235					1,947
2006 ³⁾	1,153				239	347					1,739

1) Catch in 2006 has not been updated.

2) Grey indicate a limited number of longline vessels operated and catch was combined with Hawaii longline.

3) Japanese catch in 2005 and 2006 is provisional.

Table 4. Stock Scenario-1 swordfish CPUE by fisheries, 1952-2008; “-” indicates no effort or data not available.

Standardized CPUE Stock Scenario -1														
Year	Japan					Chinese Taipei			US Hawaii			US Hawaii		
	Standardized CPUE (n/1,000 hooks)					Standardized CPUE (n/1,000 hooks)			Standardized CPUE (n/1,000 hooks)			Standardized CPUE (n/1,000 hooks)		
	Coastal-Offshore	lower cpue	upper cpue	SE ¹	CV	Distant Water	SE ¹	CV	Shallow set Longline	SE ²	CV	Deep set Longline	SE ²	CV
1951	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1952	0.231	0.167	0.322	0.040	17.1%	-	-	-	-	-	-	-	-	-
1953	0.195	0.142	0.269	0.032	16.6%	-	-	-	-	-	-	-	-	-
1954	0.269	0.196	0.372	0.045	16.7%	-	-	-	-	-	-	-	-	-
1955	0.231	0.172	0.311	0.035	15.3%	-	-	-	-	-	-	-	-	-
1956	0.188	0.141	0.251	0.028	15.1%	-	-	-	-	-	-	-	-	-
1957	0.217	0.165	0.288	0.031	14.4%	-	-	-	-	-	-	-	-	-
1958	0.261	0.198	0.346	0.038	14.4%	-	-	-	-	-	-	-	-	-
1959	0.193	0.148	0.252	0.027	13.8%	-	-	-	-	-	-	-	-	-
1960	0.223	0.172	0.291	0.030	13.5%	-	-	-	-	-	-	-	-	-
1961	0.224	0.174	0.290	0.029	13.1%	-	-	-	-	-	-	-	-	-
1962	0.223	0.175	0.286	0.028	12.6%	-	-	-	-	-	-	-	-	-
1963	0.249	0.197	0.317	0.031	12.3%	-	-	-	-	-	-	-	-	-
1964	0.234	0.185	0.298	0.029	12.3%	-	-	-	-	-	-	-	-	-
1965	0.237	0.188	0.300	0.029	12.1%	-	-	-	-	-	-	-	-	-
1966	0.248	0.195	0.316	0.031	12.5%	-	-	-	-	-	-	-	-	-
1967	0.212	0.169	0.267	0.025	11.9%	-	-	-	-	-	-	-	-	-
1968	0.199	0.158	0.252	0.024	12.0%	-	-	-	-	-	-	-	-	-
1969	0.221	0.175	0.279	0.026	12.0%	-	-	-	-	-	-	-	-	-
1970	0.257	0.205	0.325	0.030	11.8%	-	-	-	-	-	-	-	-	-
1971	0.243	0.192	0.308	0.030	12.2%	-	-	-	-	-	-	-	-	-
1972	0.238	0.187	0.304	0.030	12.5%	-	-	-	-	-	-	-	-	-
1973	0.280	0.221	0.356	0.035	12.3%	-	-	-	-	-	-	-	-	-
1974	0.279	0.220	0.355	0.034	12.3%	-	-	-	-	-	-	-	-	-
1975	0.227	0.172	0.303	0.033	14.7%	-	-	-	-	-	-	-	-	-
1976	0.260	0.207	0.328	0.031	11.8%	-	-	-	-	-	-	-	-	-
1977	0.247	0.198	0.310	0.028	11.6%	-	-	-	-	-	-	-	-	-
1978	0.211	0.170	0.263	0.024	11.3%	-	-	-	-	-	-	-	-	-
1979	0.206	0.167	0.255	0.022	10.9%	-	-	-	-	-	-	-	-	-
1980	0.251	0.200	0.314	0.029	11.6%	-	-	-	-	-	-	-	-	-
1981	0.215	0.174	0.267	0.024	11.1%	-	-	-	-	-	-	-	-	-
1982	0.201	0.162	0.250	0.022	11.1%	-	-	-	-	-	-	-	-	-
1983	0.281	0.224	0.354	0.033	11.8%	-	-	-	-	-	-	-	-	-
1984	0.233	0.188	0.289	0.026	11.1%	-	-	-	-	-	-	-	-	-
1985	0.328	0.263	0.409	0.037	11.4%	-	-	-	-	-	-	-	-	-
1986	0.345	0.275	0.433	0.040	11.7%	-	-	-	-	-	-	-	-	-
1987	0.408	0.326	0.512	0.047	11.6%	-	-	-	-	-	-	-	-	-
1988	0.327	0.258	0.416	0.040	12.3%	-	-	-	-	-	-	-	-	-
1989	0.290	0.233	0.361	0.033	11.3%	-	-	-	-	-	-	-	-	-
1990	0.325	0.256	0.413	0.040	12.3%	-	-	-	-	-	-	-	-	-
1991	0.258	0.203	0.327	0.032	12.2%	-	-	-	-	-	-	0.137	0.022	16.0%
1992	0.280	0.217	0.363	0.037	13.3%	-	-	-	-	-	-	0.052	0.012	22.3%
1993	0.270	0.210	0.347	0.035	13.0%	-	-	-	-	-	-	0.097	0.020	20.4%
1994	0.222	0.180	0.274	0.024	10.8%	-	-	-	-	-	-	0.090	0.017	18.5%
1995	0.201	0.162	0.248	0.022	10.9%	0.180	0.152	84.7%	7.12	0.078	1.10%	0.063	0.013	20.7%
1996	0.228	0.179	0.291	0.029	12.6%	0.203	0.094	46.2%	10.18	0.094	0.92%	0.106	0.018	16.7%
1997	0.208	0.162	0.267	0.027	12.9%	0.152	0.097	64.0%	9.66	0.091	0.95%	0.085	0.019	22.7%
1998	0.188	0.146	0.242	0.025	13.1%	0.139	0.129	93.1%	10.46	0.069	0.66%	0.141	0.045	31.9%
1999	0.219	0.168	0.289	0.031	14.1%	0.167	0.091	54.3%	14.24	0.118	0.83%	0.025	-	-
2000	0.342	0.270	0.434	0.042	12.3%	0.360	0.080	22.2%	14.45	0.139	0.96%	0.221	0.002	0.77%
2001	0.452	0.362	0.565	0.052	11.5%	0.487	0.037	7.56%	-	-	-	0.162	0.002	1.20%
2002	0.333	0.252	0.443	0.049	14.7%	0.431	0.031	7.18%	-	-	-	0.120	0.001	1.11%
2003	0.256	0.197	0.334	0.035	13.7%	0.346	0.034	9.82%	-	-	-	0.097	0.001	0.93%
2004	0.266	0.189	0.386	0.050	18.8%	0.349	0.025	7.02%	13.00	0.196	1.51%	0.272	0.002	1.10%
2005	0.228	0.158	0.354	0.050	21.9%	0.255	0.026	10.1%	15.95	0.104	0.65%	0.008	0.001	0.36%
2006	0.333	0.228	0.514	0.073	21.9%	0.293	0.027	9.32%	15.95	0.104	0.65%	0.194	0.001	0.48%
2007	-	-	-	-	-	0.332	0.034	10.37%	20.04	0.092	0.46%	0.142	0.000	0.33%
2008	-	-	-	-	-	-	-	-	15.66	0.076	0.48%	0.158	0.001	0.44%
									-	-	-	0.078	0.039	50.1%

- 1) SE from GLM.
2) SE of ratio estimate from GAM.
3) SE from Bootstrap.

Table 5. Stock Scenario-2 (Sub Area-1) swordfish CPUE by fisheries, 1952-2008; “-” indicates no effort or data not available.

CPUE Stock Scenario-2 (Sub Area-1)																				
	Japan						Chinese Taipei			US Hawaii			US Hawaii			US California				
	Standardized CPUE (n/1,000 hooks)						Standardized CPUE (n/1,000 hooks)			Standardized CPUE (n/1,000 hooks)			Standardized CPUE (n/1,000 hooks)			Standardized CPUE (n/1,000 FMHRS)				
Year	Coastal+Offshore	lower cpue	upper cpue	SE ¹	CV		Distant Water	SE ¹	CV	Shallow set	Longline	SE ²	CV	Deep set	Longline	SE ²	CV	Gillnet	SE ³	CV
1951	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1952	0.205	0.146	0.288	0.036	18%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1953	0.173	0.125	0.241	0.030	17%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1954	0.240	0.173	0.337	0.042	17%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1955	0.216	0.159	0.294	0.034	16%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1956	0.174	0.129	0.236	0.027	16%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1957	0.184	0.137	0.249	0.029	16%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1958	0.256	0.192	0.344	0.039	15%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1959	0.192	0.145	0.255	0.028	15%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1960	0.213	0.162	0.282	0.031	14%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1961	0.207	0.157	0.275	0.030	15%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1962	0.193	0.147	0.255	0.028	14%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1963	0.222	0.170	0.293	0.031	14%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1964	0.199	0.152	0.263	0.029	14%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1965	0.229	0.177	0.298	0.031	13%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1966	0.229	0.176	0.300	0.032	14%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1967	0.189	0.148	0.245	0.025	13%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1968	0.167	0.129	0.217	0.022	13%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1969	0.179	0.138	0.233	0.024	14%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1970	0.195	0.152	0.252	0.025	13%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1971	0.194	0.150	0.254	0.026	14%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1972	0.183	0.139	0.242	0.026	14%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1973	0.217	0.166	0.286	0.030	14%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1974	0.248	0.191	0.325	0.034	14%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1975	0.219	0.161	0.301	0.036	16%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1976	0.251	0.195	0.326	0.034	13%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1977	0.209	0.161	0.274	0.029	14%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1978	0.184	0.145	0.234	0.023	12%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1979	0.206	0.163	0.261	0.025	12%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1980	0.257	0.204	0.326	0.031	12%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1981	0.231	0.187	0.287	0.025	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1982	0.219	0.174	0.275	0.026	12%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1983	0.307	0.244	0.388	0.037	12%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1984	0.270	0.216	0.337	0.031	12%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1985	0.371	0.293	0.472	0.046	12%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1986	0.350	0.280	0.441	0.041	12%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1987	0.392	0.311	0.496	0.047	12%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1988	0.364	0.288	0.461	0.044	12%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1989	0.278	0.219	0.355	0.035	12%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1990	0.325	0.250	0.423	0.044	14%	-	-	-	-	-	-	-	-	-	-	-	-	0.137	0.022	16.0%
1991	0.275	0.212	0.357	0.037	13%	-	-	-	-	-	-	-	-	-	-	-	-	0.052	0.012	22.3%
1992	0.303	0.230	0.399	0.043	14%	-	-	-	-	-	-	-	-	-	-	-	-	0.097	0.020	20.4%
1993	0.297	0.227	0.390	0.041	14%	-	-	-	-	-	-	-	-	-	-	-	-	0.090	0.017	18.5%
1994	0.228	0.180	0.288	0.027	12%	-	-	-	-	-	-	-	-	-	-	-	-	0.063	0.013	20.7%
1995	0.197	0.156	0.250	0.024	12%	0.123	0.140	114%	7.12	0.08	1.10%	-	0.317	0.007	2.27%	-	-	0.106	0.018	16.7%
1996	0.196	0.153	0.251	0.025	13%	0.124	0.086	70%	10.18	0.09	0.92%	-	0.113	0.002	1.36%	-	-	0.085	0.019	22.7%
1997	0.141	0.108	0.183	0.019	14%	0.114	0.088	77%	9.66	0.09	0.95%	-	0.109	0.001	0.89%	-	-	0.141	0.045	31.9%
1998	0.140	0.108	0.183	0.019	14%	0.091	0.117	129%	10.46	0.07	0.66%	-	0.221	0.002	0.77%	-	-	0.025	-	-
1999	0.169	0.132	0.217	0.022	13%	0.111	0.083	75%	14.24	0.12	0.83%	-	0.162	0.002	1.20%	-	-	0.105	0.034	32.1%
2000	0.192	0.149	0.249	0.026	13%	0.210	0.081	39%	14.45	0.14	0.96%	-	0.120	0.001	1.11%	-	-	0.040	0.017	42.0%
2001	0.240	0.183	0.317	0.034	14%	0.237	0.069	29%	-	-	-	-	0.125	0.001	0.93%	-	-	0.272	0.296	108.9%
2002	0.207	0.156	0.275	0.030	15%	0.298	0.063	21%	-	-	-	-	0.195	0.002	1.10%	-	-	0.008	0.001	16.0%
2003	0.161	0.125	0.209	0.021	13%	0.238	0.053	22%	-	-	-	-	0.230	0.002	0.71%	-	-	-	-	-
2004	0.172	0.130	0.227	0.025	14%	0.251	0.031	13%	13.00	0.20	1.51%	-	0.194	0.001	0.36%	-	-	-	-	-
2005	0.180	0.134	0.251	0.030	17%	0.175	0.029	17%	15.95	0.10	0.65%	-	0.140	0.001	0.48%	-	-	0.106	-	-
2006	0.216	0.165	0.284	0.030	14%	0.184	0.035	19%	20.04	0.09	0.46%	-	0.142	0.000	0.33%	-	-	0.359	0.043	11.9%
2007	-	-	-	-	-	0.183	0.041	23%	15.66	0.08	0.48%	-	0.158	0.001	0.44%	-	-	0.207	0.038	18.2%
2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.078	0.039	50.1%

- 1) SE from GLM.
2) SE of ratio estimate from GAM.
3) SE from Bootstrap.

Table 6. Stock Scenario-2 (Sub Area-2) swordfish CPUE by fisheries, 1955-2007; Blank indicates no effort, “-” indicates data not available.

CPUE Stock Scenario-2 (Sub Area-2)																			
	Japan					Chinese Taipei			US Hawaii				US Hawaii			US California			
	Standardized CPUE (n/hook)					Standardized CPUE (n/1,000 hooks)			Standardized CPUE (n/1,000 hooks)				Standardized CPUE (n/1,000 hooks)			Standardized CPUE (n/1,000 FMHRS)			
Year	Coastal+Offshore	lower cpue	upper cpue	SE ¹	CV	Distant Water	SE ¹	CV	Shallow set	Longline	SE ²	CV	Deep set	Longline	SE ²	CV	Gillnet	SE ³	CV
1951	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1952	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1953	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1955	0.063	0.029	0.134	0.027	42%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1956	0.044	0.014	0.121	0.027	62%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1957	0.189	0.130	0.276	0.037	20%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1958	0.107	0.078	0.147	0.018	16%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1959	0.061	0.044	0.084	0.010	17%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1960	0.082	0.061	0.112	0.013	16%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1961	0.145	0.114	0.186	0.018	13%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1962	0.175	0.140	0.218	0.020	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1963	0.205	0.168	0.251	0.021	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1964	0.200	0.163	0.245	0.021	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1965	0.166	0.135	0.205	0.018	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1966	0.192	0.155	0.239	0.021	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1967	0.173	0.141	0.214	0.019	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1968	0.187	0.151	0.233	0.021	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1969	0.238	0.195	0.292	0.025	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1970	0.289	0.235	0.357	0.031	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1971	0.196	0.157	0.245	0.023	12%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1972	0.181	0.146	0.225	0.020	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1973	0.227	0.184	0.283	0.025	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1974	0.228	0.184	0.282	0.025	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1975	0.219	0.170	0.286	0.030	14%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1976	0.203	0.167	0.248	0.021	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1977	0.238	0.200	0.283	0.021	9%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1978	0.181	0.150	0.219	0.018	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1979	0.165	0.134	0.205	0.018	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1980	0.173	0.141	0.211	0.018	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1981	0.143	0.117	0.176	0.015	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1982	0.127	0.103	0.158	0.014	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1983	0.150	0.120	0.187	0.017	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1984	0.074	0.060	0.091	0.008	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1985	0.098	0.080	0.121	0.010	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1986	0.145	0.119	0.177	0.015	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1987	0.185	0.154	0.223	0.018	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1988	0.130	0.105	0.161	0.015	11%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1989	0.131	0.109	0.157	0.012	9%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1990	0.157	0.130	0.191	0.015	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1991	0.123	0.103	0.148	0.011	9%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1992	0.126	0.104	0.152	0.012	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1993	0.137	0.113	0.166	0.013	10%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1994	0.116	0.099	0.135	0.009	8%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1995	0.130	0.110	0.154	0.011	9%	0.161	0.299	185%	-	-	-	-	-	-	-	-	-	-	-
1996	0.159	0.131	0.192	0.016	10%	0.302	0.260	86%	-	-	-	-	-	-	-	-	-	-	-
1997	0.198	0.160	0.245	0.022	11%	0.441	0.543	123%	-	-	-	-	-	-	-	-	-	-	-
1998	0.234	0.191	0.287	0.024	10%	0.233	0.224	96%	-	-	-	-	-	-	-	-	-	-	-
1999	0.199	0.156	0.258	0.026	13%	0.161	0.146	91%	-	-	-	-	-	-	-	-	-	-	-
2000	0.260	0.212	0.322	0.028	11%	0.354	0.106	30%	-	-	-	-	-	-	-	-	-	-	-
2001	0.326	0.273	0.389	0.030	9%	0.500	0.031	6%	-	-	-	-	-	-	-	-	-	-	-
2002	0.259	0.209	0.329	0.031	12%	0.464	0.025	5%	-	-	-	-	-	-	-	-	-	-	-
2003	0.262	0.207	0.345	0.035	13%	0.385	0.026	7%	-	-	-	-	-	-	-	-	-	-	-
2004	0.227	0.174	0.302	0.033	14%	0.409	0.026	6%	-	-	-	-	-	-	-	-	-	-	-
2005	0.191	0.139	0.281	0.036	19%	0.293	0.027	9%	-	-	-	-	-	-	-	-	-	-	-
2006	0.272	0.195	0.400	0.052	19%	0.329	0.029	9%	-	-	-	-	-	-	-	-	-	-	-
2007	-	-	-	-	-	0.410	0.042	10%	-	-	-	-	-	-	-	-	-	-	-

- 1) SE from GLM.
- 2) SE of ratio estimate from GAM.
- 3) SE from Bootstrap.

Table 7. Correlation coefficients (r), sample sizes (n), and P-values from standardized estimates of North Pacific swordfish CPUE compared by country and gear type within each stock scenario.

		A. Stock Scenario - 1			
		Japan	Chinese Taipei	US Hawaii Shallow	US Hawaii Deep
Chinese Taipei	R	0.89			
	N	12			
	P-value	0.0001			
US Hawaii Shallow	r	0.10	0.13		
	n	10	11		
	P-value	0.7811	0.7096		
US Hawaii Deep	r	-0.36	-0.16	-0.34	
	n	12	13	11	
	P-value	0.2482	0.5974	0.3099	
US California Gillnet	r	0.48	0.26	0.35	-0.27
	n	15	11	10	11
	P-value	0.0702	0.4317	0.3149	0.4153

		B. Stock Scenario-2 (Sub Area-1)			
		Japan	Chinese Taipei	US Hawaii Shallow	US Hawaii Deep
Chinese Taipei	r	0.48			
	n	12			
	P-value	0.1180			
US Hawaii Shallow	r	0.06	0.25		
	n	10	11		
	P-value	0.8791	0.4584		
US Hawaii Deep	r	-0.15	-0.02	Same as above	
	n	12	13		
	P-value	0.6527	0.9497		
US California Gillnet	r	0.10	0.10	Same as above	Same as above
	n	15	11		
	P-value	0.7138	0.7729		

		C. Stock Scenario - 2 (Sub-Area 2)	
		Japan	
Chinese Taipei	r	0.67	
	n	12	
	P-value	0.0178	

Table 8. Correlation coefficients (r), sample sizes (n), and P-values from standardized estimates of North Pacific swordfish CPUE compared by country and gear type among stock scenarios.

Stock Scenario - 2 (Sub-Area 1)		Stock Scenario-2 (Sub Area-2)	
		Japan	Chinese Taipei
Japan (1955 - 2006) ¹	R	-0.31	
	N	52	
	P-value	0.0256	
Japan (1970 - 2006) ²	R	-0.49	
	N	37	
	P-value	0.0019	
Japan (1995 - 2006) ³	R	0.37	
	N	12	
	P-value	0.2349	
Chinese Taipei	R	0.63	0.71
	N	12	13
	P-value	0.0273	0.0069
US Hawaii Shallow	R	0.23	-0.01
	N	10	11
	P-value	0.5168	0.9730
US Hawaii Deep	R	-0.31	-0.43
	N	12	13
	P-value	0.3328	0.1375
US California Gillnet	R	0.43	0.27
	N	15	11
	P-value	0.1090	0.4257

1 All data (1955 - 2006)

2 More recent data (1970 - 2006)

3 Same years as Chinese Taipei (1955-2006)

Figures

Stock Scenario - 1

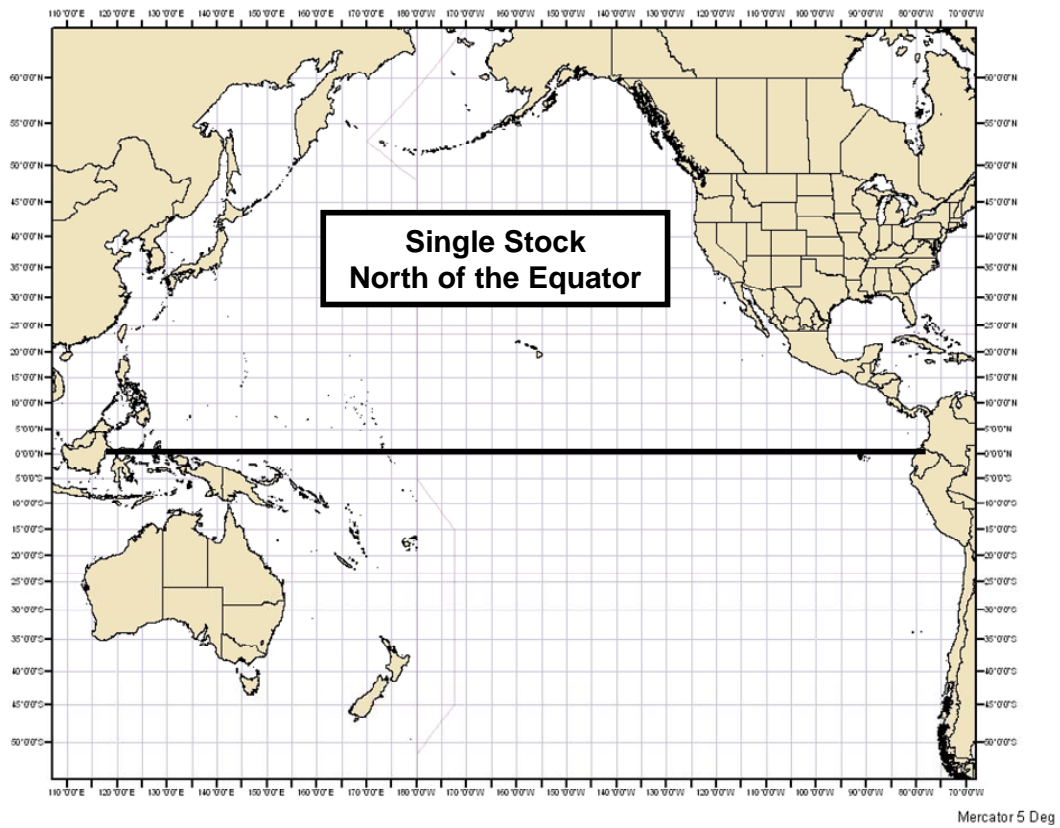


Figure 1. Stock Scenario-1, single North Pacific stock.

Putative Boundary for Stock Scenario - 2

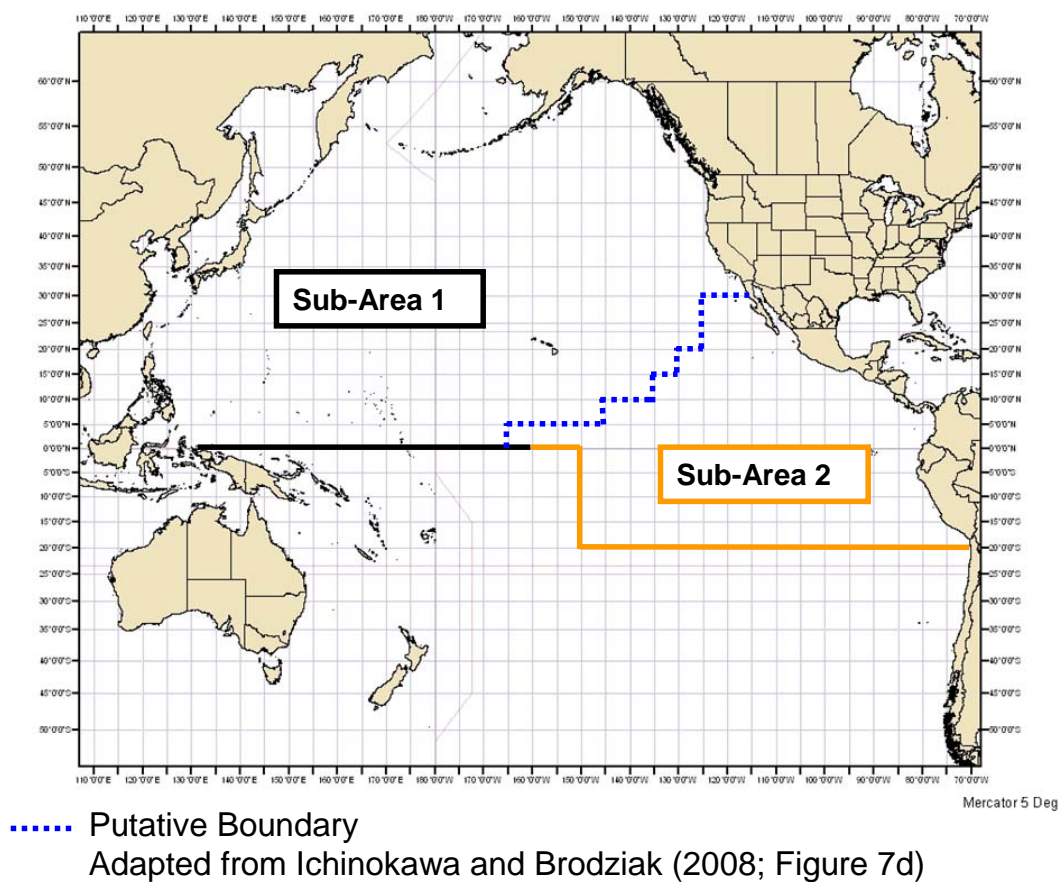


Figure 2. Putative boundary for Stock Scenario-2.

North Pacific Swordfish Single-Stock Scenario Japanese Catch per Gear

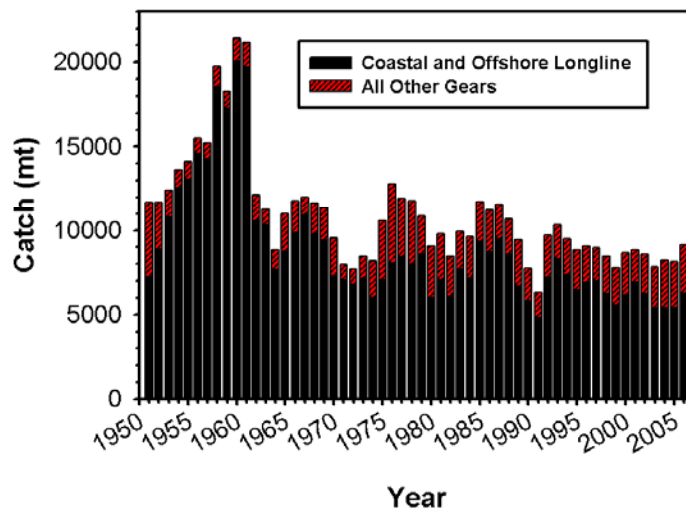


Figure 3.1. Japanese swordfish catch under Stock Scenario-1, a single North Pacific stock.

North Pacific Swordfish Single-Stock Scenario Chinese-Taipei Catch per Gear

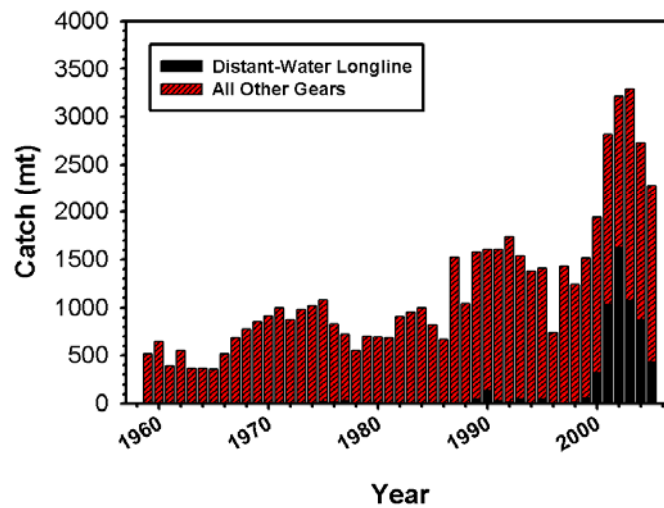


Figure 3.2. Chinese-Taipei swordfish catch under Stock Scenario-1, a single North Pacific stock.

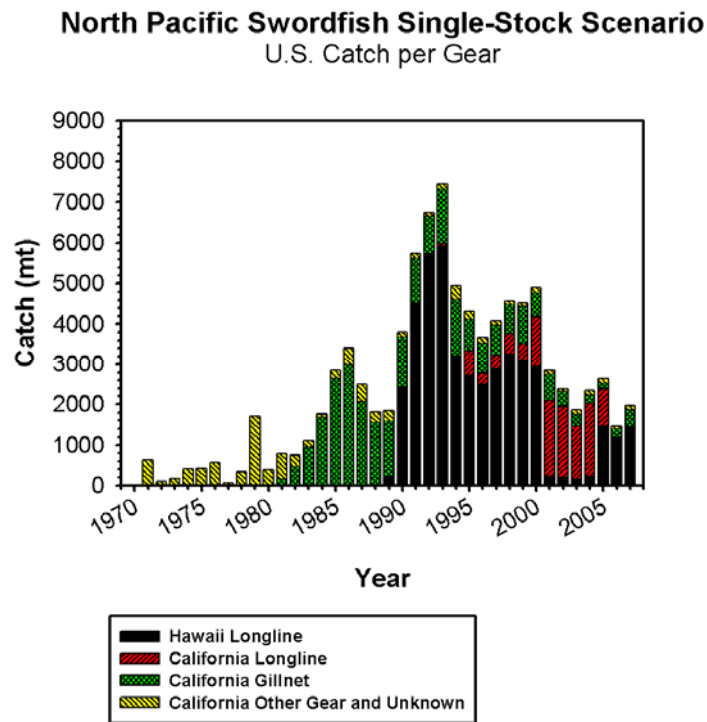


Figure 3.3. U.S. swordfish catch under Stock Scenario-1, a single North Pacific stock.

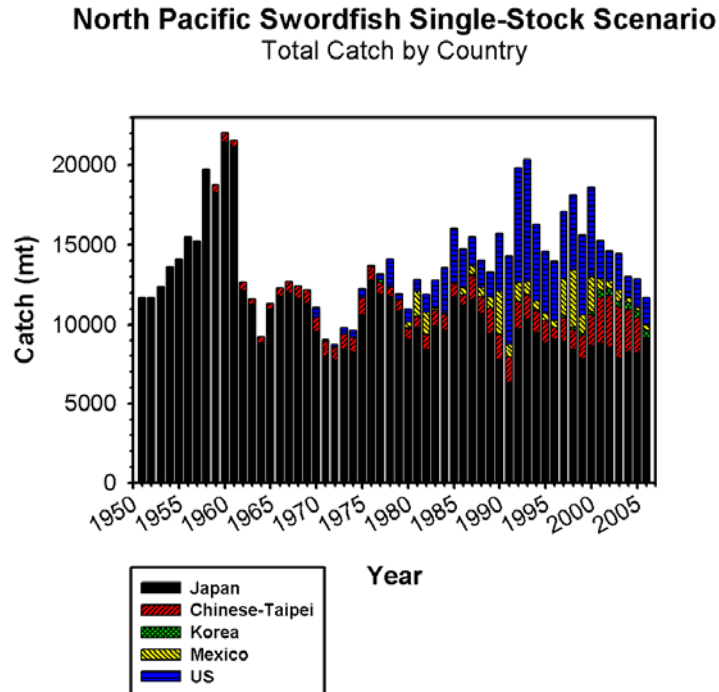


Figure 3.4. Total swordfish catch by country under Stock Scenario-1, a single North Pacific stock.

North Pacific Swordfish Two-Stock Scenario
Japanese Catch by Gear - Sub-Area 1

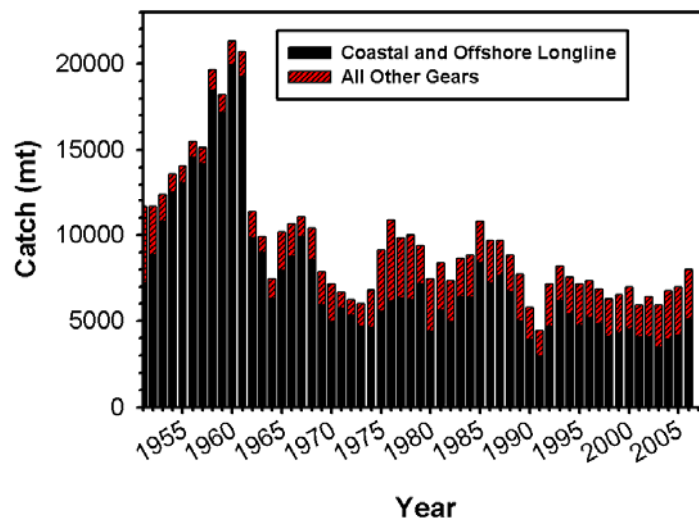


Figure 4.1. Japanese Sub-Area 1 swordfish catch under Stock Scenario-2, two North Pacific stocks.

North Pacific Swordfish Two-Stock Scenario
Japanese Catch by Gear - Sub-Area 2

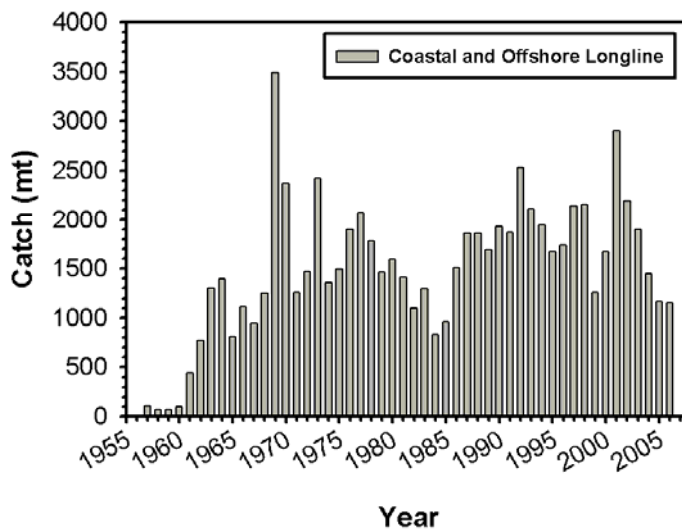


Figure 4.2. Japanese Sub-Area 2 swordfish catch under Stock Scenario-2, two North Pacific stocks.

North Pacific Swordfish Two-Stock Scenario
Chinese-Taipei Catch by Gear - Sub-Area 1

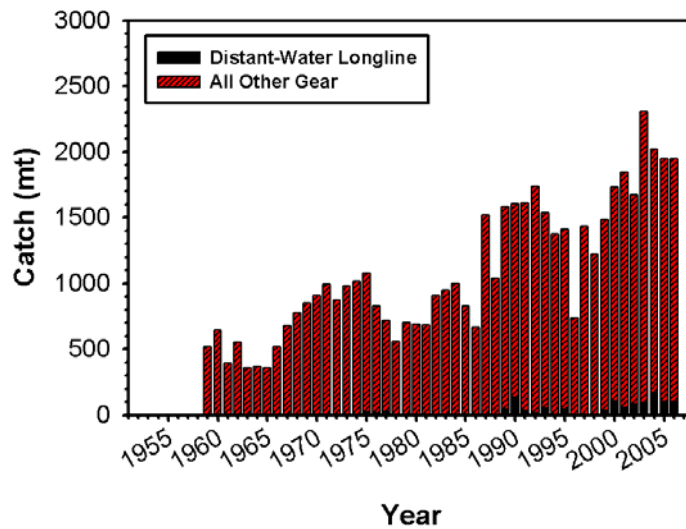


Figure 4.3. Chinese-Taipei Sub-Area 1 swordfish catch under Stock Scenario-2, two North Pacific stocks.

North Pacific Swordfish Two-Stock Scenario
Chinese-Taipei Catch by Gear - Sub-Area 2

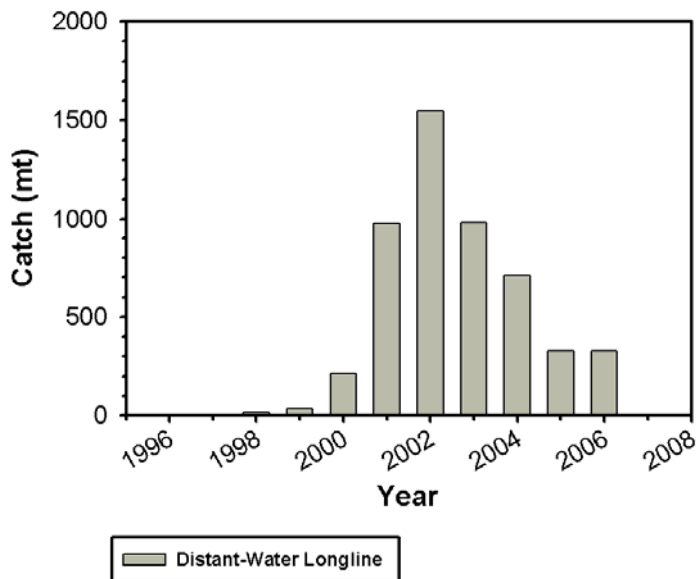


Figure 4.4. Chinese-Taipei Sub-Area 2 swordfish catch under Stock Scenario-2, two North Pacific stocks.

North Pacific Swordfish Two-Stock Scenario Korean Catch - All Gears

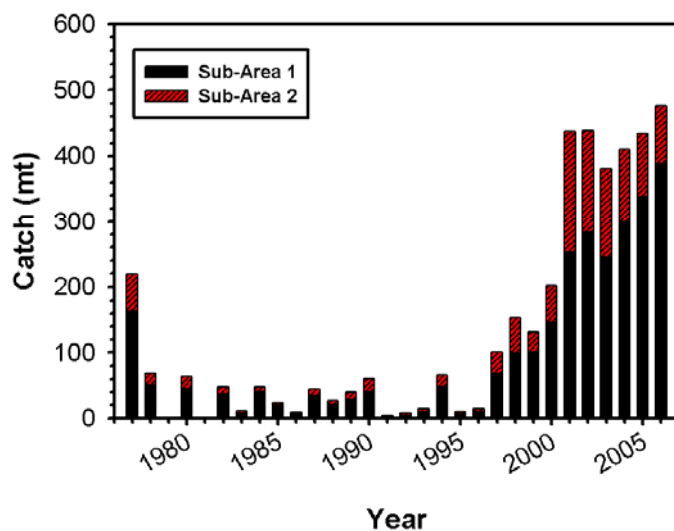


Figure 4.5. Korea swordfish catch by sub-areas under Stock Scenario-2, two North Pacific stocks.

North Pacific Swordfish Two-Stock Scenario Mexican Catch by Gear - Sub-Area 2

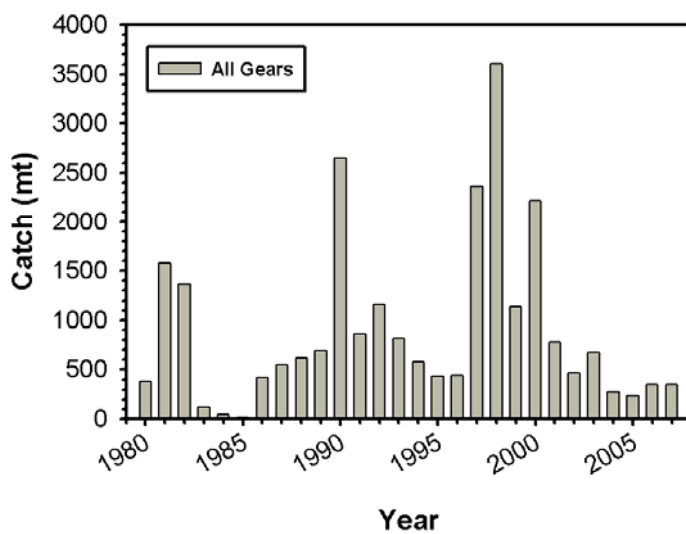


Figure 4.6. Mexican Sub-Area 2 swordfish catch under Stock Scenario-2, two North Pacific stocks.

North Pacific Swordfish Two-Stock Scenario U.S. Catch by Gear - Sub-Area 1

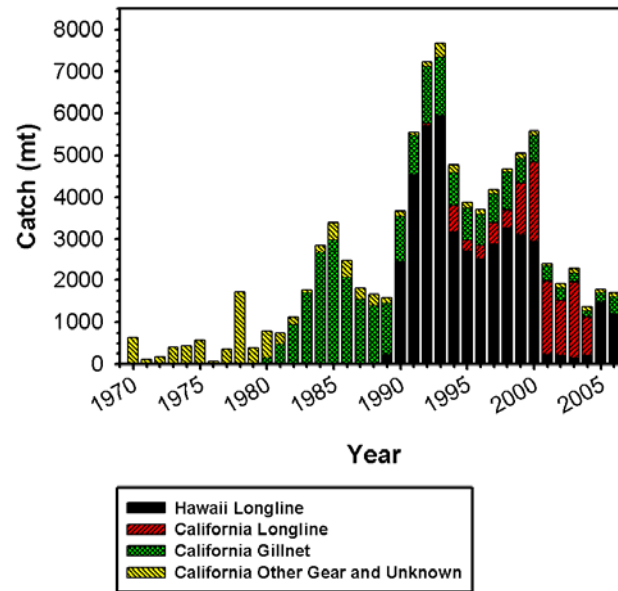


Figure 4.7. U.S. Sub-Area 1 swordfish catch under Stock Scenario-2, two North Pacific stocks.

North Pacific Swordfish Two-Stock Scenario Catch by Country - Sub-Area 1

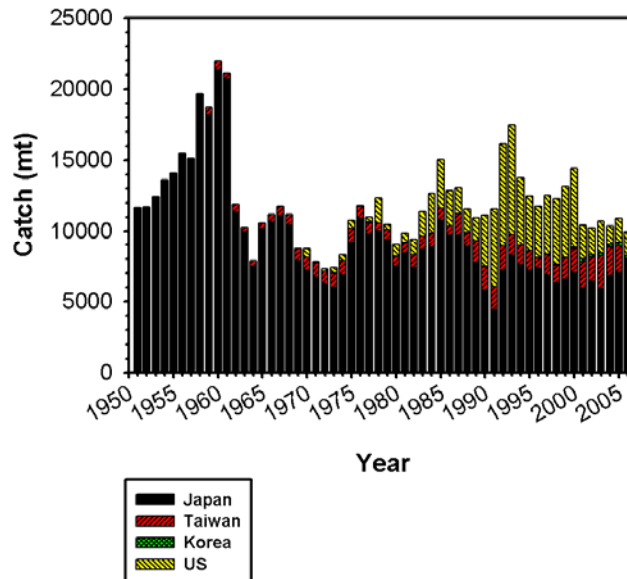


Figure 4.8. Total Sub-Area 1 swordfish catch by country under Stock Scenario-2, two North Pacific stocks.

North Pacific Swordfish Two-Stock Scenario
Catch by Country - Sub-Area 2

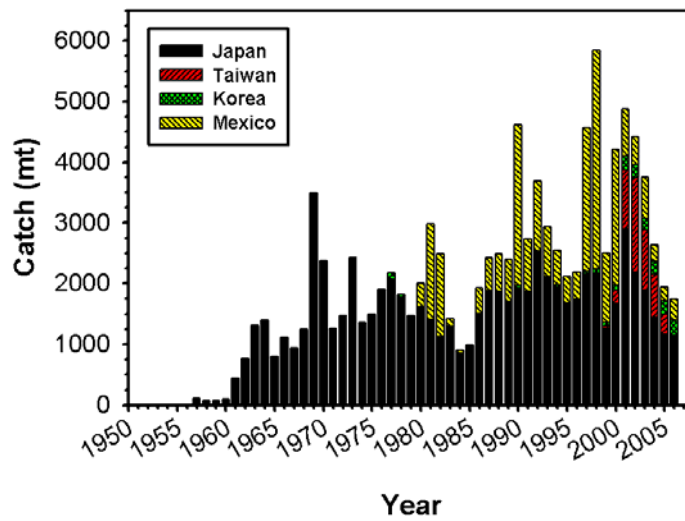


Figure 4.9. Total Sub-Area 2 swordfish catch by country under Stock Scenario-2, two North Pacific stocks.

North Pacific Swordfish Single-Stock Scenario Japanese Coastal and Offshore Longline CPUE

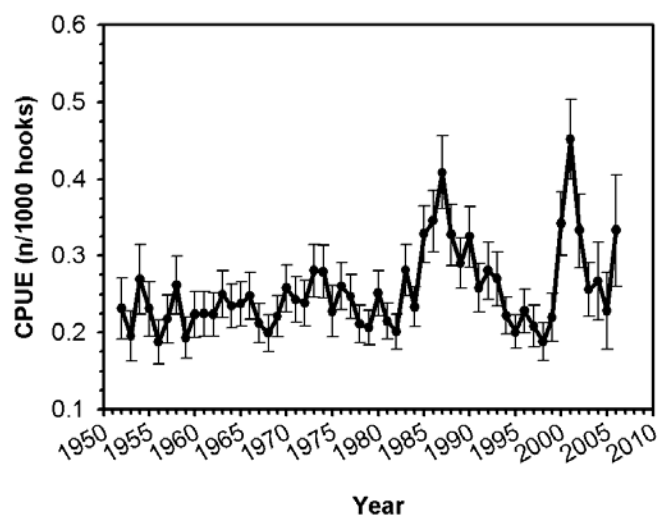


Figure 5.1. Japanese swordfish CPUE under Stock Scenario-1, a single North Pacific stock.

North Pacific Swordfish Single-Stock Scenario Chinese-Taipei Distant Water Longline CPUE

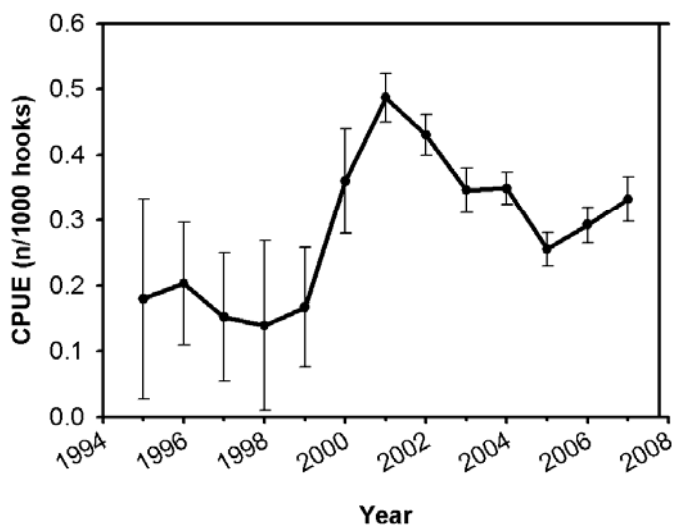


Figure 5.2. Chinese-Taipei swordfish CPUE under Stock Scenario-1, a single North Pacific stock.

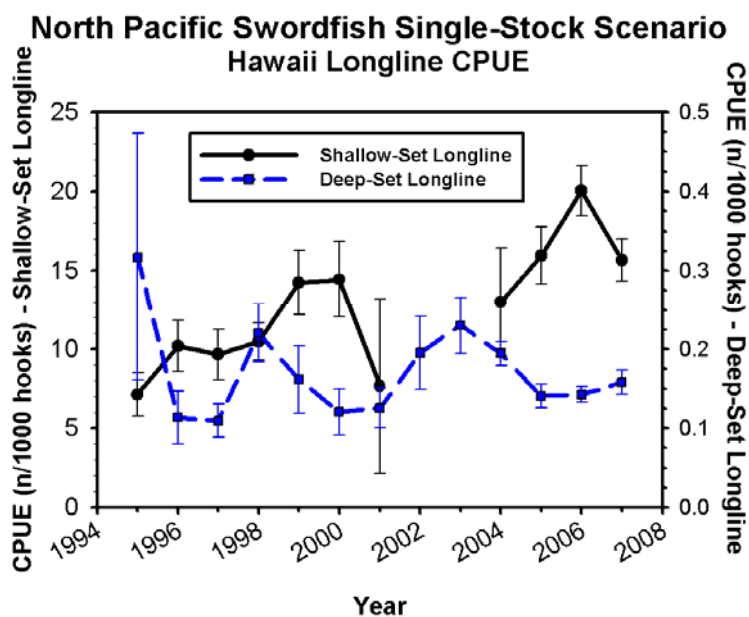


Figure 5.3. Hawaii swordfish CPUE under Stock Scenario-1, a single North Pacific stock.

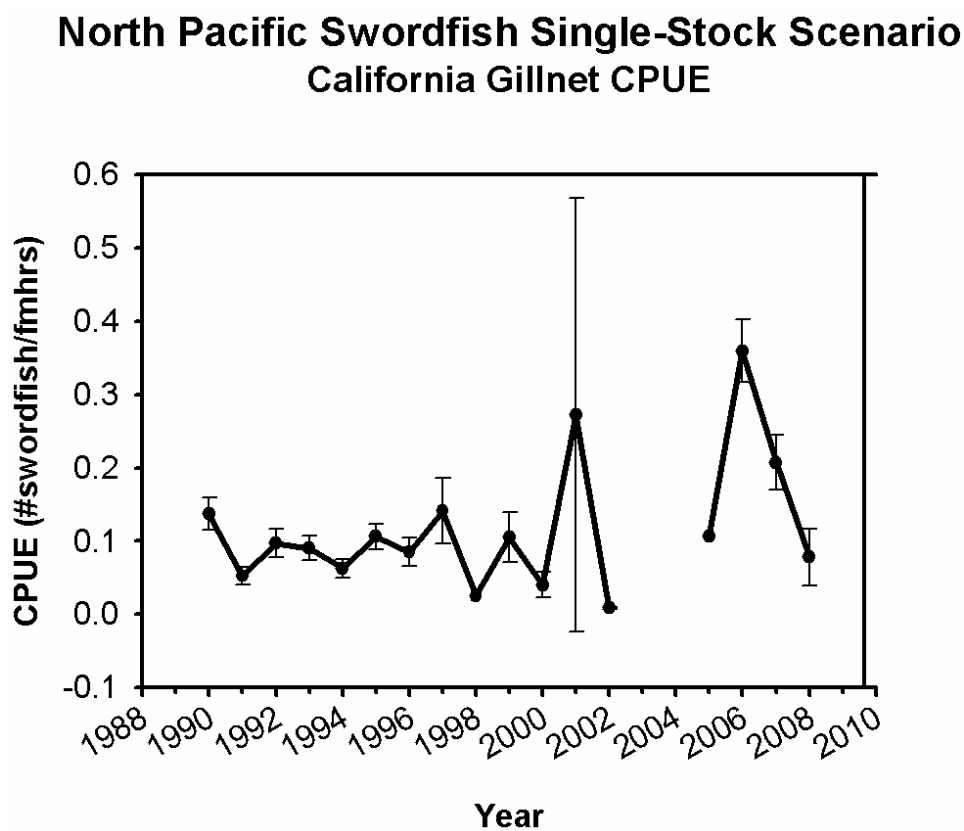


Figure 5.4. California swordfish CPUE under Stock Scenario-1, a single North Pacific stock.

North Pacific Swordfish Single Stock Scenario CPUE by Fleet

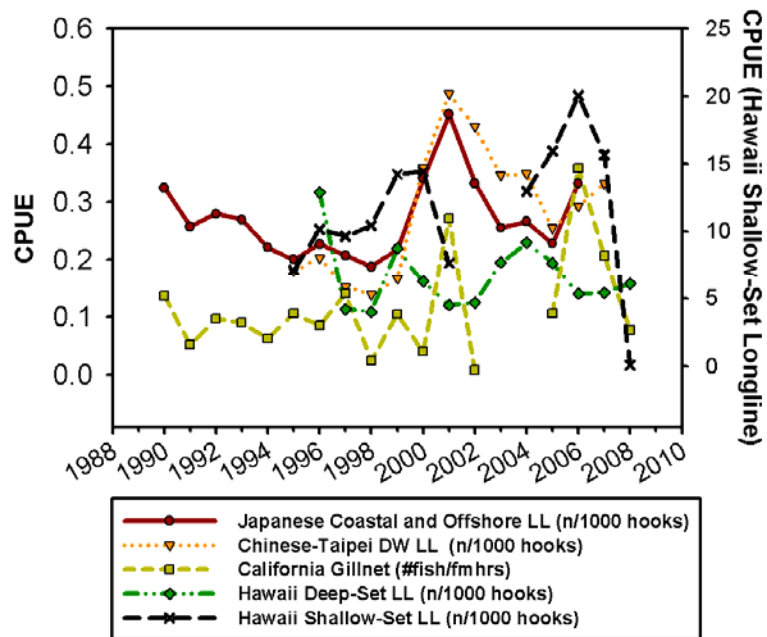


Figure 5.5. Swordfish CPUE by country and fleet under Stock Scenario-1, a single North Pacific stock.

North Pacific Swordfish Two-Stock Scenario Japanese Coastal and Offshore Longline CPUE

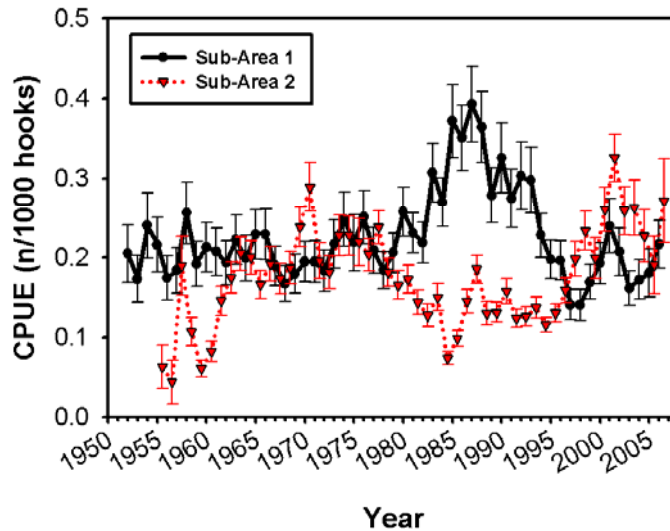


Figure 6.1. Japanese CPUE by sub-areas under Stock Scenario-2, two North Pacific stocks.

North Pacific Swordfish Two-Stock Scenario Chinese-Taipei Distant-Water Longline CPUE

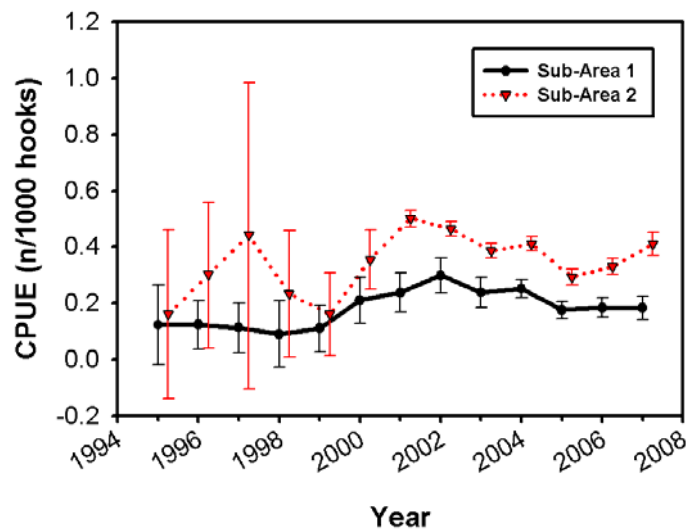


Figure 6.2. Chinese-Taipei CPUE by sub-areas under Stock Scenario-2, two North Pacific stocks.

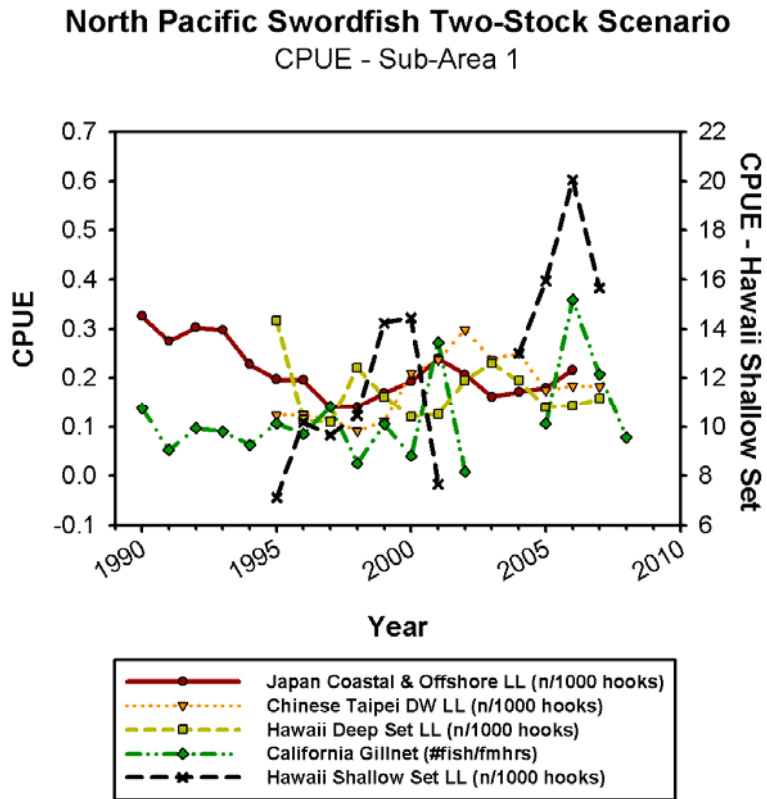


Figure 6.3. Sub-Area 1 CPUE by country and fleet under Stock Scenario-2, two North Pacific stocks.

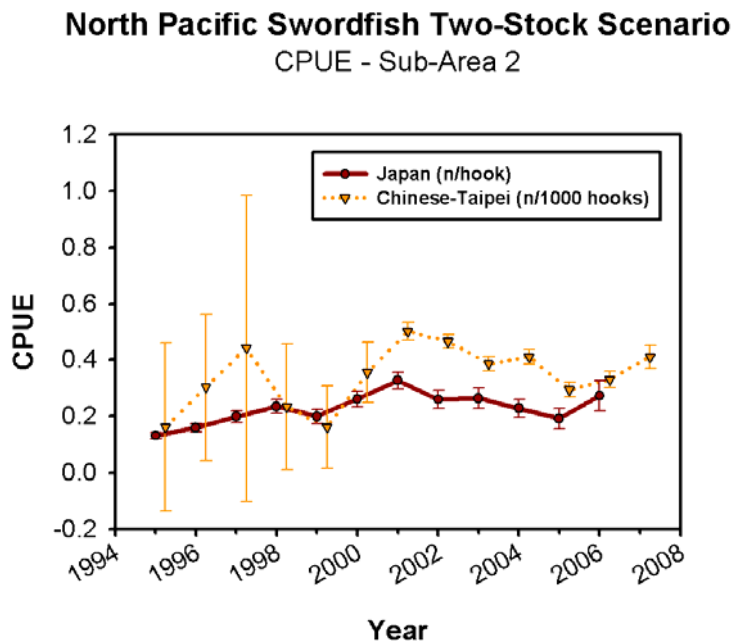


Figure 6.4. Sub-Area 2 CPUE by country under Stock Scenario-2, two North Pacific stocks.

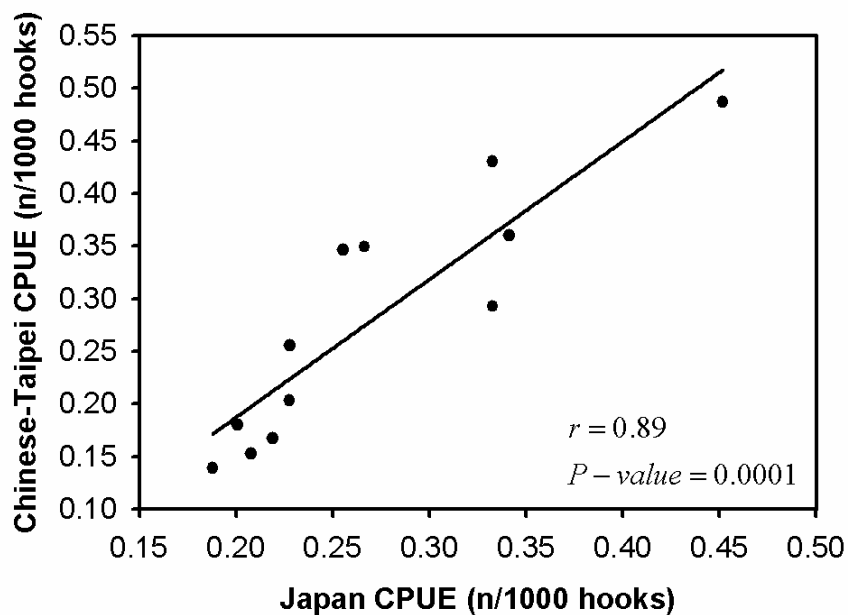


Figure 7.1. Correlation of Japanese and Chinese Taipei standardized CPUE (1995 – 2006) under Stock Scenario -1.

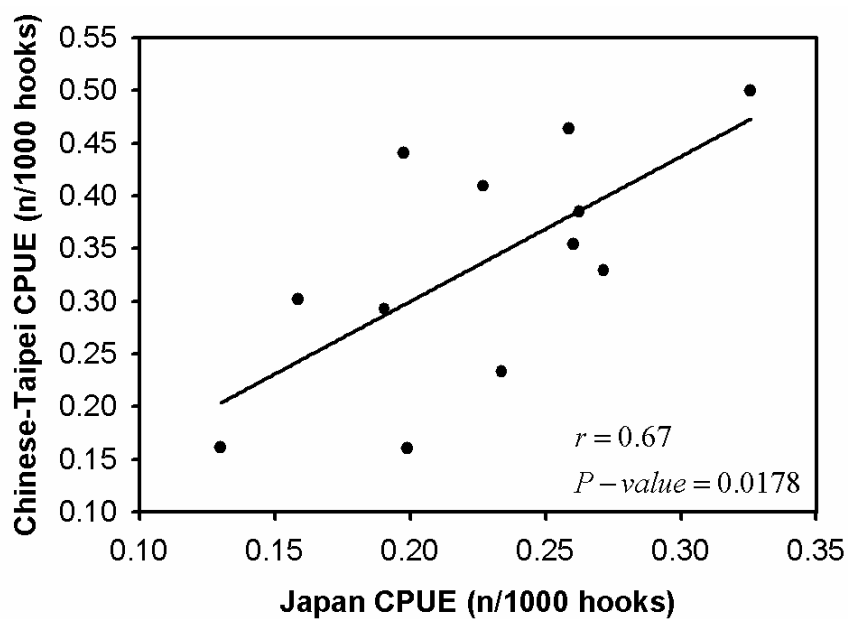


Figure 7.2. Correlation of Japanese and Chinese Taipei standardized CPUE (1995 – 2006) under Stock Scenario -2 (Sub Area-2).

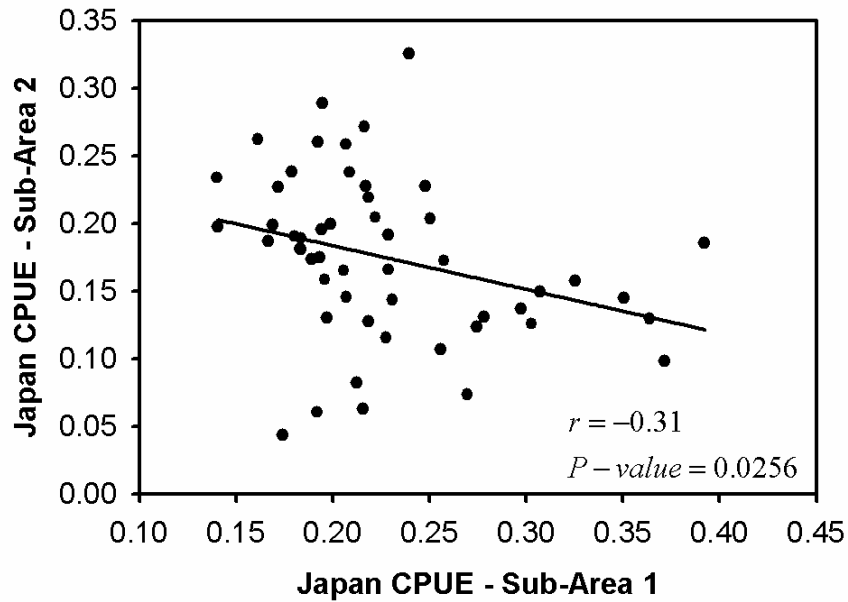


Figure 7.3. Correlation of Japanese standardized CPUE (1955 – 2006) under Stock Scenario -2 between Sub Area-1 and Sub Area-2.

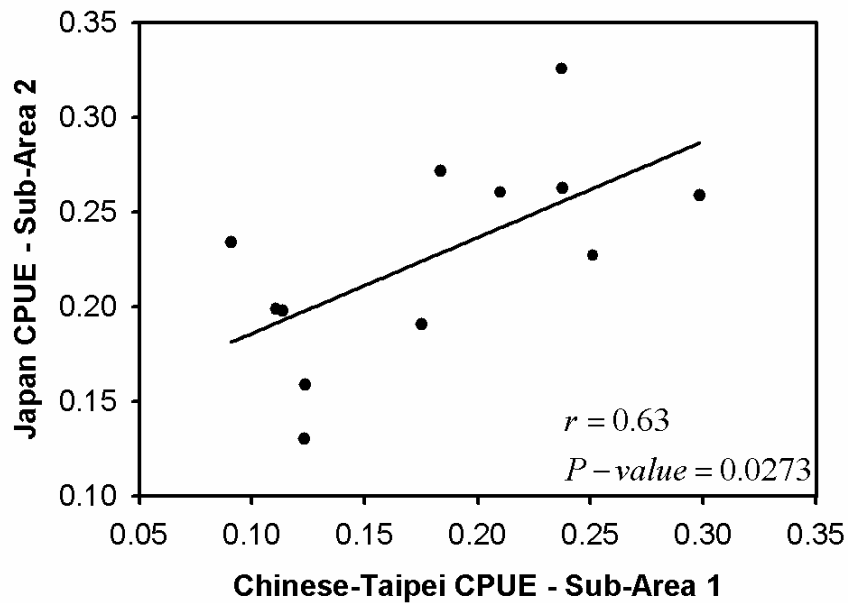


Figure 7.4. Correlation of Japanese standardized CPUE (1995 – 2006) under Stock Scenario -2 Sub Area-2 with Chinese Taipei standardized CPUE (1995 – 2006) under Stock Scenario -2 (Sub Area-1).

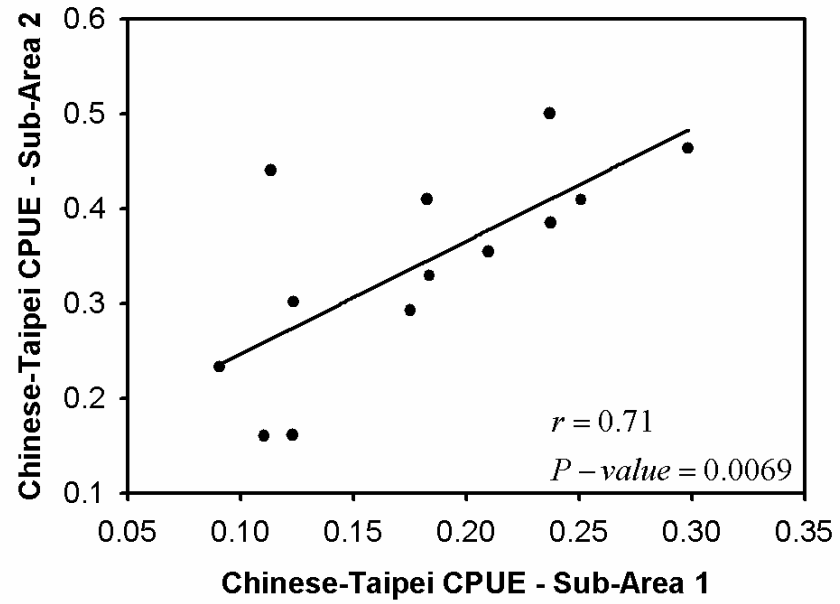


Figure 7.5. Correlation of Chinese Taipei standardized CPUE (1995 – 2006) under Stock Scenario -2 between Sub Area-1 and Sub Area-2.

Appendix A

EPO swordfish catch (%) for recent years 1960-2005 (IATTC).

In recent years (1990 – 2004), Chile (CHL) accounted for more than 30% of swordfish catch in the EPO, Spain (ESP) accounted for almost 20%, USA accounted for more than 10%, and Korea accounted for almost 5%. EPO swordfish catch within the sub-areas used for this assessment were not available.

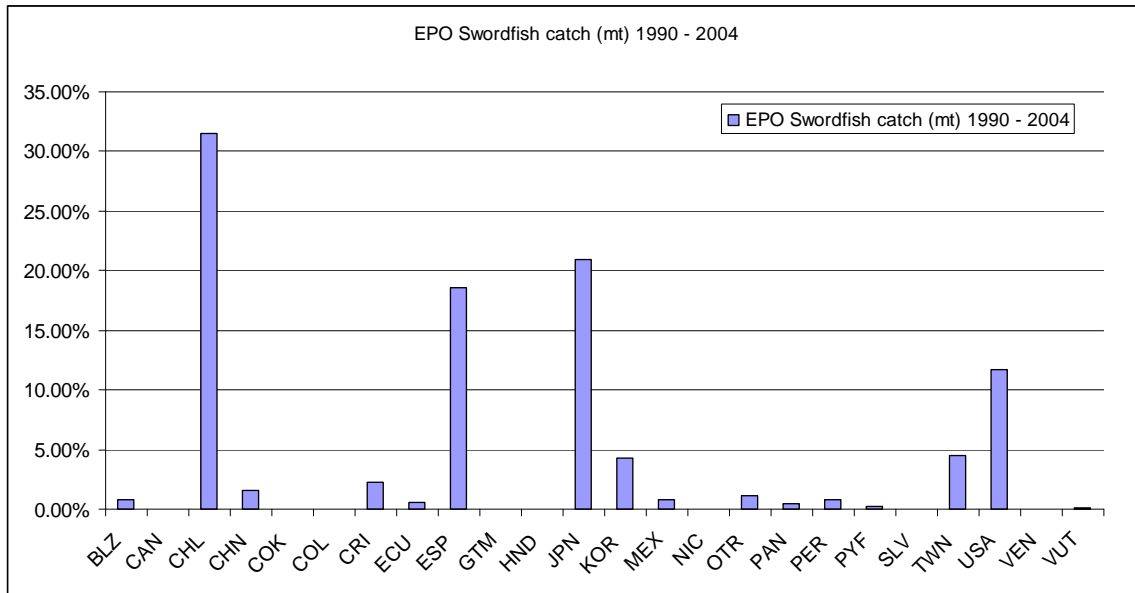


Figure 1. Percent of swordfish catch in the EPO available from recent years (www.iattc.org by year/flag for the eastern Pacific Ocean).

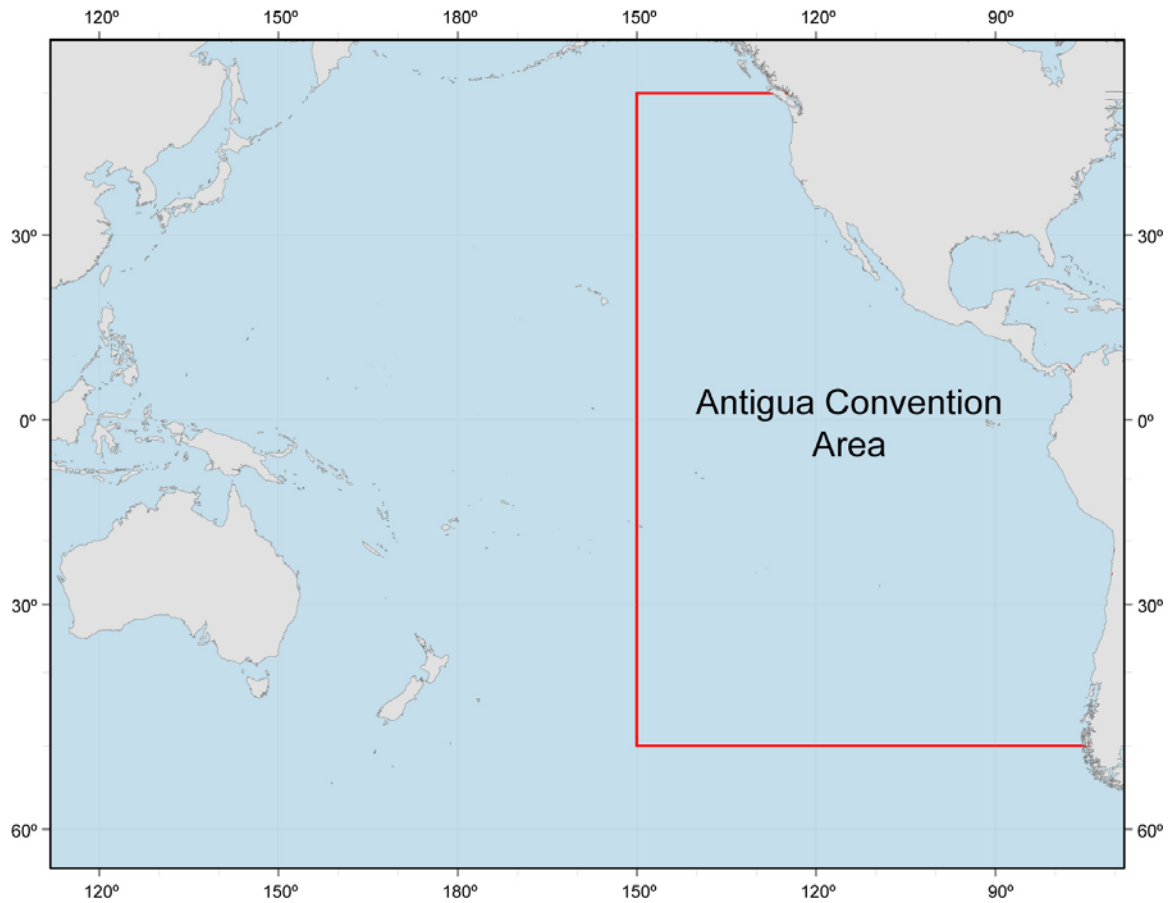


Figure 4. Inter-America Tropical Tuna Commission (IATTC) eastern Pacific Ocean (EPO) convention boundary (www.iattc.org).

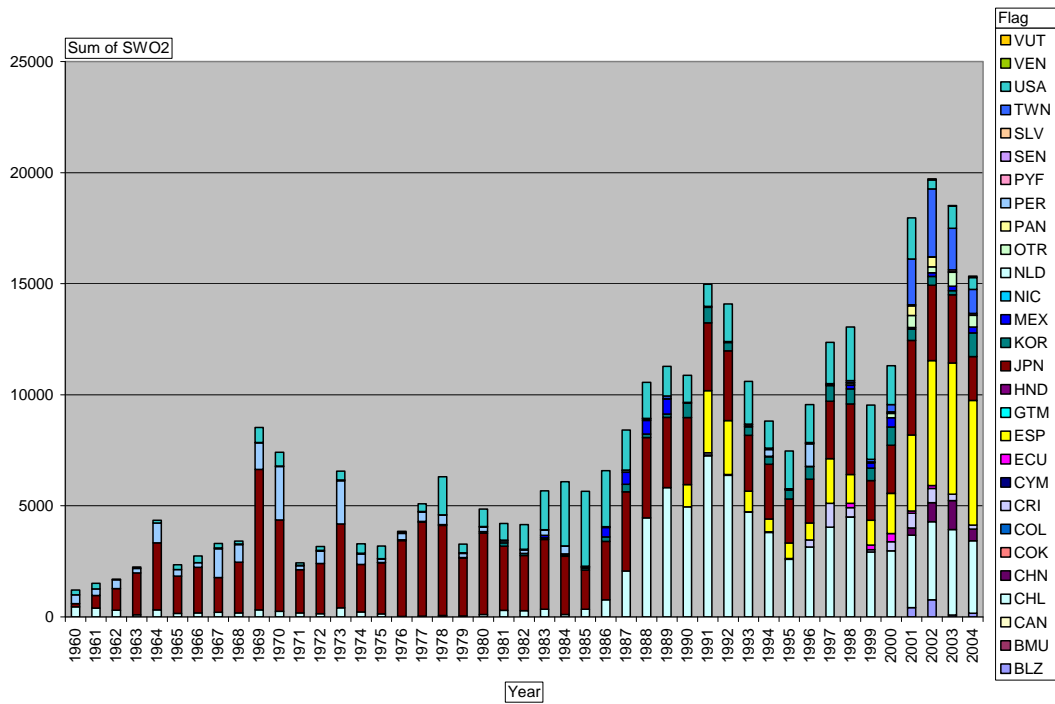


Figure 3. Swordfish catch in the EPO available from www.iattc.org by year/flag for the eastern Pacific Ocean, 1960-2005.

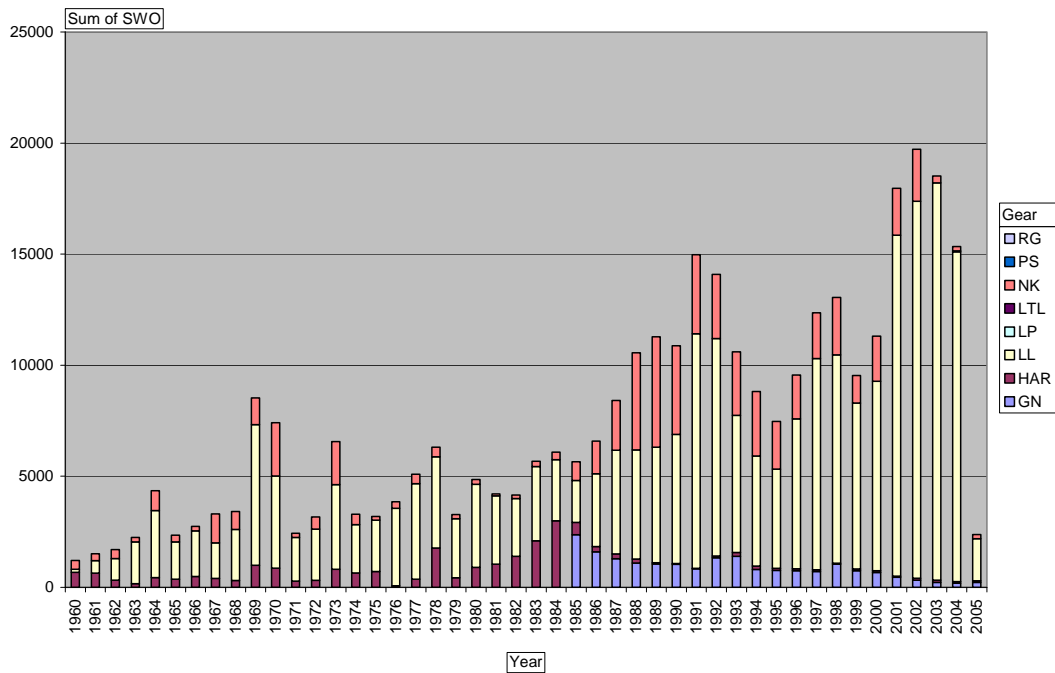


Figure 4. Swordfish catch in the EPO available from www.iattc.org by year/gear for the eastern Pacific Ocean, 1960-2005.

Table 1. Flags in the EPO available form www.iattc.org for the eastern Pacific Ocean, 1960-2005.

Flags:

BLZ	Belize
BOL	Bolivia
CAN	Canada
CHL	Chile
CHN	China
COK	Cook Islands
COL	Colombia
CRI	Costa Rica
ECU	Ecuador
ESP	Spain
GTM	Guatemala
HND	Honduras
JPN	Japan
KOR	Republic of Korea
MEX	Mexico
NIC	Nicaragua
PAN	Panama
PER	Peru
PYF	French Polynesia
SLV	El Salvador
TWN	Chinese Taipei
UNK	Unknown
USA	United States of America
VEN	Venezuela
VUT	Vanuatu

Table 2. Flags in the EPO available form www.iattc.org for the eastern Pacific Ocean, 1960-2005.

Fishing	gears:
FPN	Trap
GN	Gillnet
HAR	Harpoon
LL	Longline
LP	Pole and line
LTL	Troll
LX	Hook and line
OTR	Other2
NK	Unknown
PS	Purse seine
RG	Recreational
TX	Trawl

**Appendix B –
Swordfish catch in the Hawaii-based pelagic longline fishery, 1995-2007**

Swordfish catch (numbers) in the Hawaii-based pelagic longline fishery, 1995-2007, plotted here by 5x5 squares occurred primarily in Sub-Area 1 (Adapted from data presented in Courtney et al 2009b).

