

FISHERIES FOR PACIFIC BLUEFIN TUNA, ALBACORE TUNA, SWORDFISH, AND BLUE MARLIN IN THE PACIFIC OCEAN, AND ASSESSMENTS OF THESE SPECIES

PACIFIC BLUEFIN TUNA

Most of the catches of bluefin, *Thunnus orientalis*, in the eastern Pacific Ocean (EPO) are taken by purse seiners (Table 1). Nearly all of the purse-seine catch is made west of Baja California and California, within about 100 nautical miles of the coast, between about 23°N and 33°N. Lesser amounts of bluefin are caught by recreational, gillnet, and longline gear. Bluefin have been caught during every month of the year, but most of the fish are taken during May through October.

Bluefin are exploited by various gears in the western Pacific Ocean (WPO) from Taiwan to Hokkaido (Table 1). Age-0 fish about 15 to 30 cm in length are caught by trolling during July-October south of Shikoku Island and south of Shizuoka Prefecture. During November-April age-0 fish about 35 to 60 cm in length are taken by trolling south and west of Kyushu Island. Age-1 and older fish are caught by purse seining, mostly during May-September between about 30°-42°N and 140°-152°E. Bluefin of various sizes are also caught by traps, gillnets, and other gear, especially in the Sea of Japan. Small amounts of bluefin are also caught near the southeastern coast of Japan by longlining.

The high-seas longline fisheries are directed mainly at tropical tunas, albacore, and billfishes, but small amounts of Pacific bluefin are caught by these fisheries. Small amounts of bluefin are also caught by Japanese pole-and-line vessels on the high seas.

Larvae of Pacific bluefin have been found only between the Philippines and southern Japan and in the Sea of Japan, and it is assumed that spawning occurs only in those areas. Some fish apparently remain their entire lives in the WPO. Others migrate to the EPO; these migrations begin mostly, or perhaps entirely, during the first and second years of life. The first- and second-year migrants are exposed to various fisheries before beginning their journey to the EPO. The migrants, after crossing the ocean, are exposed to commercial and recreational fisheries off California and Baja California. Eventually, the survivors return to the WPO.

Bluefin are most often found in the EPO in waters where the sea-surface temperatures (SSTs) are between 17° and 23°C. Fish 15 to 31 cm in length are found in the WPO in waters where the SSTs are between 24° and 29°C. The survival of larval and early juvenile bluefin is undoubtedly strongly influenced by the environment. Conditions in the WPO probably influence the portions of the juvenile fish there that move to the EPO, and also the timing of these movements. Likewise, conditions in the EPO probably influence the timing of the return of the juvenile fish to the WPO.

In the absence of evidence to the contrary, it has been assumed that there is a single stock of Pacific bluefin.

Various indices of abundance of bluefin in the EPO have been calculated, but none of these is entirely satisfactory. The IATTC has calculated “habitat” and “bluefin-vessel” indices for the EPO routinely for several years.

A preliminary cohort analysis has indicated that the biomass of the spawning stock was relatively high during the 1960s, decreased during the 1970s and 1980s, and then increased during the 1990s. The recruitment was estimated to be highly variable, with four or five strong cohorts produced during the 1960-1998 period.

Even though the total catches of bluefin have not declined during the last 30 years (Table 1), the results of the yield-per-recruit and cohort analyses indicate that greater catches could be obtained if the catches of age-0 and age-1 fish were reduced or eliminated.

The spawner-recruit analyses do not indicate that the recruitment of Pacific bluefin could be increased by permitting more fish to spawn.

ALBACORE TUNA

Most scientists who have studied albacore, *Thunnus alalunga*, in the Pacific Ocean have concluded that there are two stocks, one occurring in the northern hemisphere and the other in the southern hemisphere. Albacore are caught by longliners in most of the North and South Pacific, but not often between about 10°N and 5°S, by trollers in the eastern and central North Pacific and the central South Pacific, and by baitboats in the western North Pacific. Total landings of albacore from the North Pacific peaked in the early seventies at over 100 000 metric tons per year, and then declined. Landings recovered during the 1990s, and reached an all-time high of 127 800 metric tons in 1999 (Table 2a). In the South Pacific, catches have ranged between about 25 000 and 55 000 metric tons during the 1980s and 1990s (Table 2b).

The adults are caught mostly in the Kuroshio Current, the North Pacific Transition Zone, and the California Current in the North Pacific and the Subtropical Convergence Zone in the South Pacific, but spawning occurs in tropical and subtropical waters.

There appear to be two subgroups of albacore in the North Pacific Ocean. The fish of the northern subgroup are found mostly north of 40°N when they are in the eastern Pacific Ocean. There is considerable exchange of fish of this subgroup between the troll fishery of the eastern Pacific Ocean and the baitboat and longline fisheries of the western Pacific Ocean. The fish of the southern subgroup occur mostly south of 40°N in the eastern Pacific, and relatively few of them are caught in the western Pacific. Fish that were tagged in offshore waters of the eastern Pacific and recaptured in the coastal fishery of the eastern Pacific exhibited different movements, depending on the latitude of release. Most of the recaptures of those released north of 35°N were made north of 40°N, and most of the recaptures of those released south of 35°N were made south of 40°N.

Much less is known about the movements of albacore in the South Pacific Ocean. The juveniles move southward from the tropics when they are about 35 cm long, and then eastward along the Subtropical Convergence Zone. When the fish approach maturity they return to the tropics, where they spawn. Recoveries of tagged fish released in areas east of 155°W were usually made at locations to the east and north of the release site, whereas those of fish released west of 155°W were usually made at locations to the west and north of the release site.

Production modeling indicates that the average maximum sustainable yield of albacore in the South Pacific is 30 000 to 35 000 metric tons. It should be noted, however, that in the South Pacific the catches have exceeded 30 000 metric tons in each of the last 15 years, and in 9 of these years the catches have exceeded 35 000 metric tons. Recent applications of production models to North Pacific albacore suggest that biological productivity has increased in that region. Maximum sustainable yield is estimated to have increased from about 90 000 metric tons per year in the period 1952-1988 to 150 000 metric tons per year from 1989-1998. The results of age-structured modeling in the North Pacific corroborate that finding of increased production, suggesting that recruitment and biomass have increased since the late 1980s. There does not seem to be any need to restrict the fisheries for albacore in either the North Pacific or the South Pacific.

SWORDFISH

Swordfish, *Xiphias gladius*, occur throughout the Pacific Ocean between about 50°N and 50°S (Table 3a). They are caught mostly by the longline fisheries of Far East and Western Hemisphere nations. Lesser amounts are caught by gillnet and harpoon fisheries. They are seldom caught by recreational fishermen. During recent years the greatest catches in the EPO have been taken by vessels of Chile, Japan, Mexico, and the United States (Table 3b).

Swordfish reach maturity at about 5 to 6 years of age, when they are about 150 to 170 cm in length. They probably spawn more than once per season. Unequal sex ratios occur frequently. For fish greater than 170 cm in length, the proportion of females increases with increasing length.

Only fragmentary data are available on the movements of swordfish. They tend to inhabit waters further below the surface during the day than at night.

Swordfish tend to inhabit frontal zones. Several of these occur in the EPO, including areas off California and Baja California, off Ecuador, Peru, and Chile, and in the equatorial Pacific. Swordfish tolerate temperatures of about 5° to 27°C, but their optimum range is about 18° to 22°C. Swordfish larvae have been found only at temperatures exceeding 24°C.

There are probably one or two stocks of swordfish in the EPO, one with its center of distribution in the southeastern Pacific Ocean, and possibly another with its center of distribution off California and Baja California. As well, there may be movement of a northwestern Pacific stock of swordfish into the EPO at various times.

Production modeling indicates that the catches per unit of effort (CPUEs) of swordfish, although they have declined and then increased recently, are still greater than the CPUEs which correspond to the average maximum sustainable yield. This conclusion is tentative due particularly to the current uncertainty regarding stock structure.

BLUE MARLIN

The best knowledge currently available indicates that blue marlin, *Makaira nigricans*, constitutes a single world-wide species and that there is a single stock of blue marlin in the Pacific Ocean.

Blue marlin are taken by longline vessels of many nations which fish for tunas and billfishes between about 50°N and 50°S (Table 4). Lesser amounts are taken by recreational fisheries and by various commercial surface fisheries.

Small numbers of blue marlin have been tagged, mostly by recreational fishermen, with conventional tags. A few of these fish have been recaptured long distances from the locations of release. In addition, blue marlin have been tagged with acoustical tags and their activities monitored for short periods.

Blue marlin usually inhabit regions where the sea-surface temperatures (SSTs) are greater than 24°C, and they spend about 90 percent of their time at depths in which the temperatures are within 1° to 2° of the SSTs.

The Deriso-Schnute delay-difference population dynamics model, a form of the production model, was used to assess the status of the blue marlin stock in the Pacific Ocean. Data for the estimated annual total catches (in metric tons) for 1951-1997 and standardized catch rates developed from catch and nominal fishing effort data for the Japanese longline fishery for 1955-1997 were used. It was concluded that the blue marlin stock in the Pacific is in a healthy condition, with the current level of biomass and fishing effort near the levels required to maintain the average maximum sustained yield.

A more recent analysis, using Multifan-CL, was conducted to assess the blue marlin stocks in the Pacific Ocean and to evaluate the efficacy of habitat-based standardization of longline effort. There is considerable uncertainty was regarding the levels of fishing effort that would produce the maximum sustainable yield. However, it was determined that blue marlin in the Pacific Ocean are close to fully exploited, *i.e.* the population is somewhere near the top of the yield curve. It was also found that standardization of effort, using a habitat-based model, allowed estimation of parameters within reasonable bounds and with reduced confidence intervals about the estimates.

TABLE 1. Annual catches of Pacific bluefin, in metric tons.

TABLA 1. Capturas anuales de aleta azul del Pacífico, en toneladas métricas.

Year	Western Pacific nations ¹			Eastern Pacific nations				Total
	Surface	Longline	Subtotal	Surface ²		Longline ³	Subtotal	
				Commercial	Recreational			
Año	Naciones de Pacífico occidental ¹			Naciones de Pacífico oriental				Total
	Superficie	Palangre	Subtotal	Superficie ²		Palangre ³	Subtotal	
				Comercial	Deportiva			
1970	7,505	1,123	8,628	3,966	15		3,981	12,610
1971	8,673	757	9,430	8,348	6		8,354	17,784
1972	7,951	724	8,675	13,334	12		13,346	22,020
1973	8,798	1,158	9,956	10,743	44		10,787	20,743
1974	14,763	3,533	18,296	5,617	47		5,664	23,960
1975	10,770	1,558	12,328	9,582	27		9,609	21,937
1976	9,186	520	9,706	10,645	17		10,662	20,368
1977	12,617	712	13,329	5,473	15		5,488	18,817
1978	21,285	1,049	22,334	5,398	4		5,402	27,735
1979	25,311	1,223	26,534	6,112	9		6,121	32,655
1980	18,372	1,170	19,542	2,939	6		2,945	22,487
1981	29,576	975	30,551	1,126	6		1,132	31,683
1982	24,095	1,056	25,151	3,021	7		3,028	28,179
1983	18,046	864	18,910	1,037	21		1,058	19,968
1984	10,562	831	11,393	801	31		832	12,225
1985	11,985	706	12,691	3,929	55		3,984	16,675
1986	14,496	319	14,815	4,920	7		4,927	19,742
1987	13,314	711	14,025	942	21		963	14,988
1988	7,331	349	7,680	1,250	4		1,254	8,934
1989	9,099	645	9,744	1,076	70		1,146	10,890
1990	6,294	585	6,879	975	40		1,015	7,894
1991	14,084	627	14,711	113	57		170	14,881
1992	10,221	1,037	11,258	1,088	93	9	1,190	12,448
1993	7,818	1,328	9,146	527	114	45	686	9,832
1994	10,964	1,697	12,661	972	24	24	1,020	13,681
1995	22,768	1,104	23,872	718	166	27	911	24,783
1996	10,119	1,934	12,053	8,381	30	25	8,436	20,489
1997	14,757	3,197	17,954	2,575	90	25	2,690	20,644
1998	7,357	3,170	10,527	1,908	213	54	2,175	12,702
1999	16,863	4,244	21,107	2,463	397	89	2,949	24,056
2000*	17,888	3,898	21,786	3,386	218	22	3,626	25,412
2001*	995	2,429	3,424	1,006	303	7	1,316	4,740

¹ Source: Report of the Second Meeting of the ISC [International Scientific Committee] Pacific Bluefin Tuna Working Group of the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean

¹ Fuente: Informe del Reunión Segundo del Grupo de Trabajo del ISC [Comité Científico Internacional] sobre el Atún Aleta Azul del Pacífico de la Convención sobre la Conservación y Ordenación de Poblaciones de Peces Altamente Migratorios en el Océano Pacífico Occidental y Central

² Sources: 1970-1980 and 2001, IATTC data bases; 1981-2000, Report of the Second Meeting of the Working Group of the ISC

² Fuentes: 1970-1980 y 2001, bases de datos de CIAT; 1981-2000, Informe del Reunión Segundo del Grupo de Trabajo del ISC

³ Sources: Report of the Second Meeting of the Working Group of the ISC and data bases of the IATTC and U.S. NMFS

³ Fuentes: Informe del Reunión Segundo del Grupo de Trabajo del ISC y bases de datos de la CIAT y el NMFS de EE.UU.

* preliminary—preliminares

TABLE 2a. Catches of albacore in the North Pacific Ocean, in metric tons, by gear type and flag of vessel (after Childers, 2001, U.S. NMFS, Southwest “Fish. Sci. Center, Admin. Rep. LJ-01-05: Table 1). The values in bold face are preliminary. The country codes are listed at the bottom of the table.

TABLA 2a. Capturas de albacora en el Océano Pacífico oriental norte, en toneladas métricas, por arte de pesca y pabellón de buque (de Childers, 2001, U.S. NMFS, Southwest Fish. Center, Admin. Rep. LJ-01-05: Tabla 1). Los valores en negritas son preliminares. Al pie de la tabla se explican los códigos de países.

Year Año	Longline—Palangre					Pole-and-line—Cañero			Troll—Curricán		
	JPN	KOR	TWN	USA	Total	JPN	USA	Total	CAN	USA	Total
1952	26,687			46	26,733	41,787		41,787	71	23,843	23,914
1953	27,777			23	27,800	32,921		32,921	5	15,740	15,745
1954	20,958			13	20,971	28,069		28,069		12,246	12,246
1955	16,277			9	16,286	24,236		24,236		13,264	13,264
1956	14,341			6	14,347	42,810		42,810	17	18,751	18,768
1957	21,053			4	21,057	49,500		49,500	8	21,165	21,173
1958	18,432			7	18,439	22,175		22,175	74	14,855	14,929
1959	15,802			5	15,807	14,252		14,252	212	20,990	21,202
1960	17,369			4	17,373	25,156		25,156	5	20,100	20,105
1961	17,437			5	17,442	18,639	2,837	21,476	4	12,055	12,059
1962	15,764			7	15,771	8,729	1,085	9,814	1	19,752	19,753
1963	13,464			7	13,471	26,420	2,432	28,852	5	25,140	25,145
1964	15,458		26	4	15,488	23,858	3,411	27,269	3	18,388	18,391
1965	13,701		261	3	13,965	41,491	417	41,908	15	16,542	16,557
1966	25,050		271	8	25,329	22,830	1,600	24,430	44	15,333	15,377
1967	28,869		635	12	29,516	30,481	4,113	34,594	161	17,814	17,975
1968	23,961		698	11	24,670	16,597	4,906	21,503	1,028	20,434	21,462
1969	18,006		634	14	18,654	31,912	2,996	34,908	1,365	18,827	20,192
1970	15,372		1,516	9	16,897	24,263	4,416	28,679	390	21,032	21,422
1971	11,035		1,759	11	12,805	52,957	2,071	55,028	1,746	20,526	22,272
1972	12,649		3,091	8	15,748	60,591	3,750	64,341	3,921	23,600	27,521
1973	16,059		128	14	16,201	68,808	2,236	71,044	1,400	15,653	17,053
1974	13,053		570	9	13,632	73,576	4,777	78,353	1,331	20,178	21,509
1975	10,060	2,463	1,494	33	14,050	52,157	3,243	55,400	111	18,932	19,043
1976	15,896	859	1,251	23	18,029	85,336	2,700	88,036	278	15,905	16,183
1977	15,737	792	873	37	17,439	31,934	1,497	33,431	53	9,969	10,022
1978	13,061	228	284	54	13,627	59,877	950	60,827	23	16,613	16,636
1979	14,249	259	187		14,695	44,662	303	44,965	521	6,781	7,302
1980	14,743	597	318		15,658	46,743	382	47,125	212	7,556	7,768
1981	18,020	459	339	25	18,843	27,426	748	28,174	200	12,637	12,837
1982	16,762	387	559	94	17,802	29,615	425	30,040	104	6,609	6,713
1983	15,103	454	520	6	16,083	21,098	607	21,705	225	9,359	9,584
1984	15,111	136	471	2	15,720	26,015	1,030	27,045	50	9,304	9,354
1985	14,320	291	109	0	14,720	20,714	1,498	22,212	56	6,415	6,471
1986	12,945	241			13,186	16,096	432	16,528	30	4,708	4,738
1987	14,642	182		136	14,960	19,091	158	19,249	104	2,766	2,870
1988	13,904	109	38	318	14,369	6,216	598	6,814	155	4,212	4,367
1989	13,194	81	544	272	14,091	8,629	54	8,683	140	1,860	2,000
1990	15,928	20	287	182	16,417	8,532	115	8,647	302	2,603	2,905
1991	17,043	3	353	313	17,712	7,103	0	7,103	139	1,845	1,984
1992	19,149	43	300	332	19,824	13,888	0	13,888	363	4,572	4,935
1993	29,616	43	494	440	30,593	12,809		12,809	494	6,254	6,748
1994	29,612	43	586	546	30,787	26,391	0	26,391	1,998	10,978	12,976
1995	29,080	43	2,504	879	32,506	20,981	79	21,060	1,790	7,567	9,357
1996	32,492	43	3,594	1,187	37,316	20,272	24	20,296	3,534	17,030	20,564
1997	38,988	43	4,199	1,647	44,877	32,250	73	32,323	2,524	14,014	16,538
1998	35,043	43	4,797	1,119	41,002	22,953	79	23,032	4,240	14,138	18,378
1999	35,043	43	4,768	1,493	41,347	55,784	120	55,904	2,836	10,194	13,030
2000	35,043	43	4,768	1,493	41,347	55,784	66	55,850	2,836	9,340	12,176

TABLE 2a. (continued)
TABLA 2a. (continuación)

Year Año	Gillnet—Red agallera					Purse seine—Cerco				Sport	Other—Otro				Total
	JPN	KOR	TWN	USA	Total	CAN	JPN	USA	Total	USA	JPN	MEX	USA	Total	
1952					0		154		154	1,373	237			237	94,198
1953					0		38		38	171	132			132	76,807
1954					0		23		23	147	38			38	61,494
1955					0		8		8	577	136			136	54,507
1956					0					482	57			57	76,464
1957					0		83		83	304	151			151	92,268
1958					0		8		8	48	124			124	55,723
1959					0					0	67		5	72	51,333
1960					0	136			136	557	76		4	80	63,407
1961					0		7		7	1,355	268	0	6	274	52,613
1962					0		53		53	1,681	191	0	8	199	47,271
1963					0		59		59	1,161	218	0	7	225	68,913
1964					0		128		128	824	319	0	4	323	62,423
1965					0		11		11	731	121	0	3	124	73,296
1966					0		111		111	588	585	0	9	594	66,429
1967					0		89		89	707	520		12	532	83,413
1968					0		267		267	951	1,109		10	1,119	69,972
1969					0		521		521	358	935		12	947	75,580
1970					0		317		317	822	456	0	9	465	68,602
1971					0		902		902	1,175	308	0	11	319	92,501
1972	1				1		277		277	637	623	100	8	731	109,256
1973	39				39		1,353		1,353	84	495	0	14	509	106,283
1974	224				224		161		161	94	879	1	9	889	114,862
1975	166				166		159		159	640	228	1	43	272	89,730
1976	1,070				1,070		1,109		1,109	713	272	36	27	335	125,475
1977	688				688		669		669	537	355	0	36	391	63,177
1978	4,029				4,029		1,115		1,115	810	2,078	1	69	2,148	99,192
1979	2,856	0			2,856		125		125	74	1,126	1	31	1,158	71,175
1980	2,986	6			2,992		329		329	168	1,179	31	24	1,234	75,274
1981	10,348	16			10,364		252		252	195	663	8	60	731	71,396
1982	12,511	113			12,624		561		561	257	440	7	84	531	68,528
1983	6,852	233			7,085		350		350	87	118	33	213	364	55,258
1984	8,988	516			9,504		3,380	3,728	7,108	1,427	511	113	138	762	70,920
1985	11,204	576		2	11,782		1,533		1,533	1,176	305	49	83	437	58,331
1986	7,813	726		3	8,542		1,542		1,542	196	626	3	106	735	45,467
1987	6,698	817	2,514	5	10,034		1,205		1,205	74	155	7	136	298	48,690
1988	9,074	1,016	7,389	15	17,494		1,208		1,208	64	134	15	318	467	44,783
1989	7,437	1,023	8,350	4	16,814		2,521		2,521	160	393	2	272	667	44,936
1990	6,064	1,016	16,701	29	23,810		1,995	71	2,066	24	249	2	181	432	54,301
1991	3,401	852	3,398	17	7,668		2,652	0	2,652	6	392	2	384	778	37,903
1992	2,721	271	7,866	0	10,858		4,104	0	4,104	2	1,527	10	408	1,945	55,556
1993	287			0	287		2,889		2,889	25	867	11	331	1,209	54,560
1994	263			38	301		2,026		2,026	106	799	6	712	1,517	74,104
1995	282			52	334		1,177		1,177	102	937	5	1	943	65,479
1996	116			83	199		581	11	592	88	932	21	0	953	80,008
1997	359			60	419		1,068	2	1,070	1,018	1,708	53	1	1,762	98,007
1998	206			79	285		1,554	33	1,587	1,208	1,278		1	1,279	86,771
1999	206			122	328		6,698	47	6,745	3,621	1,278		5	1,283	122,258
2000	206			48	254		6,698	4	6,702	1,798	1,278		4	1,282	119,409

CAN, Canada—Canadá; JPN, Japan—Japón; KOR, Republic of Korea—República de Corea; MEX, Mexico—México; TWN, Taiwan; USA, United States—Estados Unidos

TABLE 2b. Catches of albacore in the South Pacific Ocean, in metric tons, by gear type and flag of vessel (after Childers, 2001: Table 2). The values in bold face are preliminary. The country codes are listed at the bottom of the table. PL = pole-and-line.

TABLA 2b. Capturas de albacora en el Océano Pacífico oriental sur, en toneladas métricas, por arte de pesca y pabellón de buque (de Childers, 2001: Tabla 1). Los valores en negritas son preliminares. Al pie de la tabla se explican los códigos de países. PL = cañero.

Year Año	Longline—Palangre												Total		
	AUS	FJI	JPN	KOR	NCL	NZL	PYF	SLB	TON	TWN	USA	VUT		WSM	Other
1952			154												154
1953			803												803
1954			9,578												9,578
1955			8,625												8,625
1956			7,281												7,281
1957			8,757												8,757
1958			18,490	146											18,636
1959			17,385	456											17,841
1960			21,638	610											22,248
1961			23,412	330											23,742
1962			34,620	599											35,219
1963			29,120	1,367						608					31,095
1964			19,390	2,911						629					22,930
1965			17,793	6,405						1,640					25,838
1966			21,627	10,817						6,669					39,113
1967			15,104	13,717						11,497					40,318
1968			6,659	10,138						12,254					29,051
1969			4,894	9,963						9,503					24,360
1970			6,507	11,599						14,484					32,590
1971			4,355	14,482						15,871					34,708
1972			2,729	14,439						16,674					33,842
1973			2,452	17,452				4		17,741					37,649
1974			1,934	12,194						16,857					30,985
1975			1,060	9,015						16,056					26,131
1976			1,836	9,058				6		13,206					24,106
1977			2,182	11,229				9		21,429					34,849
1978			2,489	11,658				9		20,702					34,858
1979			2,320	11,411				21		14,987					28,739
1980			2,555	10,449				25		17,998					31,027
1981			4,898	13,342				2		14,390					32,632
1982			4,822	10,769				8	106	12,634					28,339
1983			4,991	7,069	12			19	143	12,069	5				24,308
1984			3,598	5,321	112			19	135	11,155	9				20,349
1985	0		3,676	13,544	131			12	174	9,601	11				27,149
1986	0		4,466	15,877	179				206	11,913					32,641
1987	129		4,103	6,821	563				252	15,009					26,877
1988	107		6,914	6,563	584				242	17,120	1				31,531
1989	93	3	5,353	5,151	566	9			195	10,867					22,237
1990	51	68	5,466	3,947	1,053	156	20		152	11,619	0				22,532
1991	213	208	4,700	1,866	909	66	100		171	16,508	1			4	24,746
1992	192	243	5,268	2,271	692	72	195		199	20,956	0				30,088
1993	226	463	8,294	1,083	755	206	714		231	17,701	0		213		29,886
1994	351	842	8,883		840	401	913		343	19,731	34		641	46	33,025
1995	401	702	7,350	8	332	330	772	322	379	12,775	52	109	1,883	121	25,536
1996	408	1,446	4,538	215	414	402	1,463	1,154	494	11,909	99	192	1,613	208	24,555
1997	302	1,842	5,094	845	267	469	2,595	441	494	15,662	308	95	3,736	327	32,477
1998	479	2,121	6,955	845	860	1,203	3,189	370	494	13,812	489	10	4,311	367	35,505
1999	374	2,279	6,995	845	690	1,332	2,580	111	494	13,684	302	10	3,660	95	33,451
2000	374	2,279	6,955	845	690	1,332	2,580	111	494	13,684	302	10	3,660	95	33,411

TABLE 2b. (continued)
TABLA 2b. (continuación)

Year Año	Troll—Curricán						Gillnet—Red agallera					PL	Total
	AUS	NZL	PYF	USA	Other	Total	CHL	JPN	KOR	TWN	Total	JPN	
1952													154
1953													803
1954													9,578
1955													8,625
1956													7,281
1957													8,757
1958													18,636
1959													17,841
1960												45	22,293
1961												0	23,742
1962												0	35,219
1963												16	31,111
1964												0	22,930
1965												0	25,838
1966												0	39,113
1967			5			5						0	40,323
1968			14			14						0	29,065
1969												0	24,360
1970	100	50				150						0	32,740
1971	100					100						0	34,808
1972	100	268				368						22	34,232
1973	100	484				584						41	38,274
1974	100	898				998						709	32,692
1975	100	646				746						0	26,877
1976	100	25				125						0	24,231
1977	100	621				721						0	35,570
1978	100	1,686				1,786						0	36,644
1979	100	814				914						0	29,653
1980	100	1,468				1,568						1	32,596
1981	5	2,085				2,090						0	34,722
1982	6	2,434				2,440						1	30,780
1983	7	744				751		32			32	0	25,091
1984	8	2,773				2,781		1,581			1,581	2	24,713
1985	9	3,253				3,262		1,928			1,928	0	32,339
1986	10	1,911		92		2,013		1,936			1,936	0	36,590
1987	11	1,256		793		2,060		919			919	9	29,865
1988	12	405		3,574	73	4,064		4,271		1,000	5,271	0	40,866
1989	13	4,923	102	3,510		8,548		13,263	172	8,520	21,955	0	52,740
1990	15	2,988	299	3,785		7,087		5,667		1,859	7,526	0	37,145
1991	20	2,385	326	4,821	4	7,556				1,394	1,394	0	33,696
1992	70	3,345	72	2,993		6,480						0	36,568
1993	55	3,117	45	1,027		4,244						12	34,142
1994	70	4,914		2,509	46	7,539						2	40,566
1995	25	5,865	183	1,936	121	8,130	15				15	0	33,681
1996	25	5,914	69	2,214	208	8,430	21				21	0	33,006
1997	25	3,257	24	1,929	327	5,562	0				0	12	38,051
1998	35	5,321		1,656	367	7,379	0				0	27	42,911
1999	25	2,396		1,446	95	3,962	0				0		37,413
2000	25	2,396		2,629	95	5,145	0				0		38,556

AUS, Australia; CHL, Chile; FJI, Fiji; JPN, Japan—Japón; KOR, Republic of Korea—República de Corea; NZL, New Caledonia—Nueva Caledonia; NZL, New Zealand—Nueva Zelanda; PYF, French Polynesia—Polinesia Francesa; SLB, Solomon Islands—Islas Salomón; TON, Tonga; TWN, Taiwan; USA, United States—Estados Unidos; VUT, Vanuatu; WSM, Western Samoa—Samoa Occidental.

TABLE 3a. Pacific Ocean and world catches of swordfish, in metric tons (from FAO fisheries statistics; note that FAO does not report catches by Spain in the Pacific).

TABLA 3a. Capturas de pez espada en el Océano Pacífico y mundiales, en toneladas métricas (de estadísticas de pesca de la FAO: nótese que FAO no reporta las capturas de España en el Pacífico).

Year— Año	Chile	Japan— Japón	Mexico	Philippines —Filipinas	Taiwan	USA	Other Pacific— Otros en el Pacífico	Total Pacific— Pacífico total	World— Mundial
1971	200	10,400	-	1,500	1,033	100	200	13,433	26,742
1972	100	10,400	2	1,600	1,005	100	600	13,807	28,167
1973	400	11,100	4	1,700	1,987	300	1,900	17,391	31,983
1974	218	10,498	6	1,848	1,116	295	470	14,451	29,664
1975	137	12,361	-	1,976	1,239	393	158	16,264	31,918
1976	13	15,843	-	1,558	856	39	739	19,048	33,888
1977	32	13,997	-	2,103	902	220	685	17,939	33,357
1978	56	14,333	-	890	779	1,009	634	17,701	38,478
1979	40	13,091	7	3,845	1,060	249	553	18,845	39,368
1980	104	11,953	380	1,716	1,459	489	545	16,646	40,418
1981	294	13,078	1,575	1,940	909	443	348	18,587	39,878
1982	285	11,350	1,365	3,468	1,107	726	348	18,649	43,716
1983	342	12,511	120	2,974	1,268	1,195	360	18,770	46,608
1984	103	11,986	47	2,274	1,387	2,009	352	18,158	53,543
1985	342	13,083	18	2,036	1,429	2,370	148	19,426	59,127
1986	764	14,271	422	2,089	1,357	1,585	70	20,558	61,095
1987	2,059	14,867	550	2,137	744	1,221	184	21,762	67,196
1988	4,455	15,496	613	4,034	796	1,086	239	26,719	81,222
1989	5,824	12,367	690	3,756	2,810	588	258	26,293	79,188
1990	4,955	11,341	2,650	3,187	3,245	2,150	440	27,968	75,588
1991	7,255	9,936	861	3,139	581	4,597	601	26,970	68,041
1992	6,379	15,619	1,160	4,256	800	5,948	489	34,651	82,156
1993	4,712	14,073	806	4,627	1,535	6,981	185	32,919	86,281
1994	3,801	13,530	567	3,641	2,407	4,490	171	28,607	85,774
1995	2,594	11,619	424	4,202	1,404	3,431	420	24,094	95,646
1996	3,145	9,788	428	4,002	1,302	3,695	264	22,624	82,350
1997	4,040	8,968	2,351	5,554	2,344	4,122	1,006	28,385	94,044
1998	4,492	9,897	3,575	5,670	2,678	4,631	1,157	32,100	92,846

TABLE 3b. Catches of swordfish, in metric tons, in the eastern Pacific Ocean.

TABLA 3b. Capturas de pez espada, en toneladas métricas, en el Océano Pacífico oriental.

Year— Año	CHL	COL	CRI	ECU	ESP	JPN	KOR	MEX	PER	PYF	TWN	USA	Total
1954	334	(1)	(1)	(1)	--	18	(1)	100	700	(1)	(1)	10	1,162
1955	237	(1)	(1)	(1)	--	14	(1)	(1)	400	(1)	(1)	61	712
1956	386	(1)	(1)	(1)	--	14	(1)	(1)	600	(1)	(1)	125	1,125
1957	357	(1)	(1)	(1)	--	126	(1)	(1)	600	(1)	(1)	171	1,254
1958	456	(1)	(1)	(1)	--	102	(1)	(1)	400	(1)	(1)	214	1,172
1959	555	(1)	(1)	(1)	--	74	(1)	(1)	400	(1)	(1)	203	1,232
1960	456	(1)	(1)	(1)	--	143	(1)	(1)	400	(1)	(1)	147	1,146
1961	394	(1)	(1)	(1)	--	596	(1)	(1)	300	(1)	(1)	167	1,457
1962	297	(1)	(1)	(1)	--	1,019	(1)	(1)	400	(1)	(1)	18	1,734
1963	94	(1)	(1)	(1)	--	1,979	(1)	(1)	200	(1)	(1)	44	2,317
1964	312	(1)	(1)	(1)	--	3,165	(1)	(1)	900	(1)	(1)	83	4,460
1965	151	(1)	(1)	(1)	--	1,765	(1)	(1)	300	(1)	(1)	148	2,364
1966	175	(1)	(1)	(1)	--	2,163	(1)	(1)	200	(1)	(1)	213	2,751
1967	203	(1)	(1)	(1)	--	1,646	(1)	(1)	1,300	(1)	61	138	3,348
1968	175	(1)	(1)	(1)	--	2,397	(1)	(1)	800	(1)	12	90	3,474
1969	314	(1)	(1)	(1)	--	6,638	(1)	(1)	1,200	(1)	8	468	8,628
1970	243	(1)	(1)	(1)	--	4,327	(1)	(1)	2,396	(1)	17	429	7,412
1971	200	(1)	(1)	(1)	--	1,939	(1)	(1)	185	(1)	30	102	2,456
1972	100	(1)	(1)	(1)	--	2,266	(1)	2	550	(1)	82	175	3,175
1973	400	(1)	(1)	(1)	--	3,779	(1)	4	1,941	(1)	91	403	6,618
1974	218	(1)	(1)	(1)	--	2,143	(1)	6	470	(1)	113	428	3,378
1975	137	(1)	(1)	(1)	--	2,303	9	(1)	158	(1)	48	570	3,225
1976	13	(1)	(1)	(1)	--	3,424	29	(1)	295	(1)	5	55	3,821
1977	32	(1)	(1)	(1)	--	4,234	33	(1)	420	(1)	11	337	5,067
1978	56	(1)	(1)	(1)	--	4,060	35	(1)	436	(1)	82	1,712	6,381
1979	40	(1)	(1)	(1)	--	2,610	18	7	188	(1)	20	388	3,271
1980	104	(1)	(1)	(1)	--	3,667	62	380	216	(1)	46	790	5,265
1981	294	(1)	(1)	(1)	--	2,882	153	1,575	91	(1)	38	754	5,787
1982	285	(1)	(1)	(1)	--	2,475	97	1,365	154	(1)	19	1,116	5,511
1983	342	(1)	(1)	(1)	--	3,147	65	120	238	(1)	5	1,763	5,680
1984	103	(1)	(1)	(1)	--	2,625	65	47	343	(1)	6	2,892	6,081
1985	342	(1)	(1)	(1)	--	1,764	91	18	55	(1)	6	3,420	5,696
1986	764	(1)	(1)	(1)	--	2,637	198	422	21	(1)	11	2,538	6,591

TABLE 3b. (continued)
TABLA 3b. (continuación)

Year— Año	CHL	COL	CRI	ECU	ESP	JPN	KOR	MEX	PER	PYF	TWN	USA	Total
1987	2,059	(1)	(1)	(1)	--	3,573	211	550	73	(1)	19	1,808	8,293
1988	4,455	(1)	(1)	(1)	--	3,619	24	613	54	(1)	32	1,642	10,439
1989	5,824	(1)	(1)	(1)	--	3,158	66	690	3	(1)	46	1,910	11,697
1990	4,955	(1)	(1)	352	1,007	3,015	260	2,650	1	(1)	14	1,400	13,654
1991	7,255	29	107	350	2,794	3,053	163	861	3	(1)	10	1,095	15,720
1992	6,379	(1)	27	350	2,435	3,135	61	1,160	16	5	17	1,731	15,316
1993	4,712	(1)	19	280	928	2,513	389	806	76	38	16	2,296	12,073
1994	3,801	(1)	28	117	576	2,464	261	567	310	51	55	1,939	10,169
1995	2,594	(1)	29	65	698	1,992	291	424	7	38	2	1,870	8,010
1996	3,145	(1)	315	42	772	1,968	303	428	1,013	64	28	1,553	9,631
1997	4,040	(1)	908	72	2,018	2,576	423	2,351	24	38	23	1,433	13,906
1998	4,492	6	419	193	1,367	2,811	(2)	3,575	98	44	40	949	~15,000
1999	4,266	(1)	99	190	1,150	1,535	(2)	3,600	15	46	(2)	3,241	~15,000

CHL, Chile; COL, Colombia; CRI, Costa Rica; ECU, Ecuador; ESP, Spain—España; JPN, Japan—Japón; KOR, Republic of Korea—República de Corea; MEX, México; PER, Perú; PYF, French Polynesia—Polinesia Francesa; TWN, Taiwan; USA, United States of America—Estados Unidos de America.

(1) data not available—datos no disponibles

(2) data not yet received or processed—datos todavía no recibidos o procesados

--: no fishery in EPO – no pesca en el OPO

TABLE 4. Estimated commercial catches of blue marlin, in metric tons, in the Pacific Ocean. The data were obtained from the FAO yearbooks of fisheries statistics and other sources. “Other” includes Australia, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Kiribati, Marshall Islands, New Caledonia, New Zealand, Papua New Guinea, People’s Republic of China, Solomon Islands, Tonga, and Vanuatu.

TABLA 4. Capturas comerciales estimadas de marlín azul, en toneladas métricas, en el Océano Pacífico. Los datos provienen de compendios anuales de la FAO de estadísticas de pesca y de otras fuentes. “Otros” incluye: Australia, Estados Federados de Micronesia, Fiji, Islas Cook, Islas Marshall, Islas Salomón, Kiribati, Nueva Caledonia, Nueva Zelanda, Papua Nueva Guinea, Polinesia Francesa, República Popular de China, Tonga, y Vanuatu.

Year— Año	Indonesia	Japan— Japón	Korea— Corea	México	Philippines —Filipinas	Taiwan	U.S.A— EE.UU.	Other— Otros	Total
1951	---	12,800	---	---	---	---	---	---	12,800
1952	---	8,800	---	---	---	---	---	---	8,800
1953	---	16,000	---	---	---	---	---	---	16,000
1954	---	18,400	---	---	---	---	---	---	18,400
1955	---	21,300	---	---	---	---	42	---	21,342
1956	---	24,400	---	---	---	1,100	41	---	25,541
1957	---	29,800	---	---	---	1,400	37	---	31,237
1958	---	30,300	---	---	---	1,400	27	---	31,727
1959	---	27,100	---	---	---	1,600	184	---	28,884
1960	---	25,600	---	---	---	1,700	127	---	27,427
1961	---	28,800	---	---	---	1,400	109	---	30,309
1962	---	36,200	---	---	---	1,200	72	---	37,472
1963	---	37,200	---	---	---	1,400	76	---	38,676
1964	---	20,000	---	---	---	1,800	60	---	21,860
1965	---	16,100	---	---	---	2,100	57	---	18,257
1966	---	16,200	---	---	---	2,000	52	---	18,252
1967	---	13,100	---	---	---	2,700	40	---	15,840
1968	---	11,600	---	---	---	4,400	31	---	16,031
1969	---	12,100	---	---	---	4,500	36	---	16,636
1970	---	13,800	---	---	76	689	36	---	14,601
1971	---	8,700	---	---	85	2,142	10	---	10,937
1972	---	10,500	---	---	88	1,873	5	---	12,466
1973	---	11,000	---	---	104	3,937	7	---	15,049
1974	---	9,466	---	---	122	1,868	11	---	11,467
1975	---	8,225	---	---	124	3,293	9	---	11,651
1976	---	9,620	1,058	---	104	2,017	16	---	12,816
1977	---	10,423	784	---	149	1,985	38	---	13,379
1978	156	12,421	556	---	88	2,313	47	---	15,581
1979	164	12,238	854	---	116	2,472	23	---	15,866
1980	189	13,375	824	---	150	4,477	15	---	19,030
1981	231	13,628	964	---	207	2,582	18	11	17,642
1982	462	13,803	710	---	243	2,919	15	28	18,179
1983	134	13,189	270	8	362	3,725	14	32	17,734
1984	214	15,214	375	---	164	3,591	31	49	19,638
1985	316	11,764	199	---	232	3,698	36	33	16,279
1986	312	13,915	192	23	308	3,513	28	11	18,302
1987	1,185	14,464	210	56	484	4,405	338	55	21,197
1988	1,245	11,753	518	13	406	3,775	408	35	18,152
1989	656	11,165	82	---	442	5,875	746	26	18,992
1990	706	9,875	86	---	283	6,294	719	37	17,999
1991	776	10,275	165	---	333	6,228	729	34	18,540
1992	799	11,170	110	---	156	6,499	685	108	19,528
1993	799	12,251	84	---	134	4,634	679	438	19,019
1994	589	13,936	5	---	180	7,569	724	1,045	24,049
1995	600	11,991	1	---	170	9,802	965	1,111	24,639
1996	600	6,559	23	---	171	7,328	895	621	16,196
1997	600	6,008	323	---	171	8,056	878	449	16,486

LAS PESQUERIAS DE ATUN ALETA AZUL DEL PACIFICO, ATUN ALBACORA, PEZ ESPADA, Y MARLIN AZUL EN EL OCEANO PACIFICO, Y EVALUACIONES DE ESTAS ESPECIES

ATUN ALETA AZUL DEL PACIFICO

La mayoría de las capturas de aleta azul, *Thunnus orientalis*, en el Océano Pacífico oriental (OPO) es realizada por buques cerqueros (Tabla 1). Casi toda la captura cerquera proviene de una zona frente a Baja California y California, a menos de unas 100 millas náuticas de la costa, entre 23°N y 33°N. Se capturan cantidades menores de aleta azul con arte de pesca deportiva, redes agalleras, y palangres. Se captura la especie en todos los meses del año, pero la mayor parte de la captura es lograda entre mayo y octubre.

El aleta azul es pescado con varias artes en el Océano Pacífico occidental desde Taiwan hasta Hokkaido (Tabla 1). Peces de 0 años de edad de entre unos 15 y 30 cm de talla son capturados con curricán durante julio-octubre al sur de Shikoku y al sur de la Prefectura de Shizuoka. Durante noviembre-abril peces de edad 0 de entre unos 35 y 60 cm son capturados con curricán al sur y oeste de Kyushu. Peces de edad 1 y mayores son capturados con redes de cerco, principalmente durante mayo-septiembre entre 30°-42°N y 140°-152°E. Se capturan también aletas azules de varios tamaños con trampas, redes agalleras, y otras artes de pesca, especialmente en el Mar de Japón. Se capturan también con palangre pequeñas cantidades de la especie cerca del litoral sudeste de Japón.

Las pesquerías palangreras de alta mar están dirigidas principalmente hacia los atunes tropicales, la albacora, y los peces picudos, pero capturan pequeñas cantidades de aleta azul del Pacífico. Buques cañeros japoneses capturan asimismo pequeñas cantidades de aleta azul en alta mar.

Se han encontrado larvas de aleta azul del Pacífico únicamente entre las Filipinas y el sur del Japón y en el Mar de Japón, y se supone que el desove ocurre solamente en esas zonas. Algunos peces permanecen aparentemente toda la vida en el Pacífico occidental. Otros migran al OPO; estas migraciones comienzan principalmente, o tal vez exclusivamente, durante el primer y segundo año de vida. Los migrantes de primer o segundo año están expuestos a varias pesquerías antes de iniciar su migración al OPO. Después de cruzar el océano, están expuestos a las pesquerías comercial y deportiva frente a California y Baja California. Posteriormente, los supervivientes regresan al Pacífico occidental.

Se encuentra el aleta azul en el OPO con mayor frecuencia en aguas de entre 17° y 23°C de temperatura de superficie. En el Pacífico occidental se encuentran peces de entre 15 y 31 cm en aguas de entre 24° y 29°C de temperatura de superficie. La supervivencia de las larvas y juveniles tempranos de la especie es indudablemente afectada de manera importante por las condiciones ambientales. Las condiciones en el Pacífico occidental afectan probablemente cuáles porciones de los peces juveniles migran al OPO, y cuándo. Asimismo, las condiciones en el OPO probablemente afectan cuándo los peces juveniles regresan al Pacífico occidental.

A falta de evidencias al contrario, se supone que existe un solo stock de aleta azul del Pacífico.

Se han calculado varios índices de abundancia para el aleta azul en el OPO, pero ninguno es completamente satisfactorio. Desde hace varios años el personal de la CIAT calcula rutinariamente índices de “buque que pesca aleta azul” y “hábitat” para el OPO.

Un análisis de cohortes preliminar indicó que la biomasa del stock reproductor fue relativamente elevada durante los años 1960, disminuyó durante los años 1970 y 1980, y luego aumentó. Se estimó que el reclutamiento fue altamente variable, con cuatro o cinco cohortes fuertes producidas entre 1960 y 1998.

Pese a que las capturas totales de aleta azul no han disminuido en los últimos 30 años (Tabla 1), los resultados de análisis de rendimiento por recluta y de cohortes indican que sería posible obtener capturas mayores si se redujeran o eliminaran las capturas de peces de edad 0 y de edad 1.

Los análisis reproductor-recluta no indican que aumentaría el reclutamiento del aleta azul del Pacífico si

se permitiera a más peces desovar.

ATUN ALBACORA

La mayoría de los científicos que estudian el atún albacora, *Thunnus alalunga*, en el Océano Pacífico creen que existen dos stocks, uno en el hemisferio norte y el otro en el hemisferio sur. La especie es capturada por palangreros en la mayor parte del Pacífico norte y sur, pero rara vez entre aproximadamente 10°N y 5°S, por curricaneros en el Pacífico oriental, central norte y central sur, y por barcos de carnada en el Pacífico occidental norte. Las descargas totales de albacora del Pacífico norte alcanzaron su nivel máximo de más de 100.000 toneladas anuales a principios de la década de los 1970, y luego disminuyeron. En los años 1990 volvieron a aumentar, y en 1999 alcanzaron el nivel récord de 127.800 toneladas (Tabla 2a). En el Pacífico sur las capturas variaron entre unas 25 mil y 55 mil toneladas durante los años 1980 y 1990 (Tabla 2b).

Los adultos son capturados principalmente en la Corriente de Kuroshio, la Zona de Transición del Pacífico Norte, y la Corriente de California en el Pacífico norte y la Zona de Convergencia Subtropical en el Pacífico sur, pero el desove ocurre en aguas tropicales y subtropicales.

Parecen haber dos subgrupos de albacora en el Océano Pacífico norte. Se encuentran los peces en el subgrupo norteño principalmente al norte de 40°N cuando están en el Pacífico oriental. Ocurre un intercambio considerable de peces de este subgrupo entre la pesquería curricanera del Pacífico oriental y las pesquerías con carnada y palangre del Pacífico occidental. Los peces del subgrupo sureño ocurren principalmente al sur de 40°N en el Pacífico oriental, y se capturan relativamente pocos de éstos en el Pacífico occidental. Peces marcados en alta mar en el Pacífico oriental y recapturados en la pesquería costera del Pacífico oriental mostraron desplazamientos distintos, según la latitud en la que fueron marcados. La mayoría de los peces recapturados al norte de 40°N fueron marcados al norte de 35°N, y la mayoría de aquéllos recapturados al sur de 40°N fueron marcados al sur de 35°N.

Se sabe mucho menos acerca de los desplazamientos de albacora en el Pacífico sur. Los juveniles se desplazan de los trópicos hacia el sur cuando miden unos 35 cm, y luego hacia el este por la Zona de Convergencia Subtropical. Poco antes de alcanzar la madurez vuelven a los trópicos, donde desovan. Marcas fijadas en peces liberados al este de 155°O fueron recuperadas generalmente en lugares al este y norte del punto de liberación, mientras que aquéllas fijadas al oeste de 155°O fueron recuperadas generalmente en lugares al oeste y norte del punto de liberación.

Los modelos de producción indican que el rendimiento promedio máximo sostenible de albacora en el Pacífico sur es de unas 30 a 35 mil toneladas. Cabe destacar, sin embargo, que en el Pacífico sur las capturas han rebasado las 30 mil toneladas en cada uno de los últimos 14 años y las 35 mil toneladas en 8 de éstos. Aplicaciones recientes de modelos de producción a la albacora del Pacífico norte señalan que la productividad biológica ha aumentado en esa región. Se estima que el rendimiento máximo sostenible ha aumentado de unas 90.000 toneladas anuales durante 1952-1988 a 150.000 toneladas anuales entre 1989 y 1998. Los resultados del modelo con estructura de edades en el Pacífico norte corroboran este resultado de un aumento en la producción, sugiriendo que el reclutamiento y la biomasa han aumentado desde fines de la década de los 1980. No parece haber ninguna necesidad de limitar la pesca de albacora en el Pacífico norte ni sur.

PEZ ESPADA

El pez espada, *Xiphias gladius*, ocurre en todo el Océano Pacífico entre 50°N y 50°S, aproximadamente (Tabla 3a). Es capturado principalmente por las pesquerías palangreras de países de Lejano Oriente y del hemisferio occidental. Las pesquerías con red agallera y de arpón capturan cantidades menores. Es rara vez capturado en la pesca deportiva. En los últimos años buques de Chile, Estados Unidos, Japón, y México lograron las mayores capturas en el OPO (Tabla 3b).

El pez espada alcanza la madurez a la edad de 5 a 6 años, cuando mide unos 150 a 170 cm de talla. Es

probable que desove más de una vez por temporada. Ocurren frecuentemente proporciones desiguales de sexos. Para peces de más de 170 cm, la proporción de hembras aumenta con el aumento en la talla.

Existen solamente datos fragmentarios sobre los desplazamientos del pez espada. Suele permanecer a mayor profundidad de día que de noche.

El pez espada suele vivir en zonas frontales. Hay varias en el OPO, entre ellas zonas frente a California y Baja California, frente a Ecuador, Perú, y Chile, y en el Pacífico ecuatorial. El pez espada tolera temperaturas de entre unos 5° y 27°C, pero su rango óptimo es de 18° a 22°C. Se han encontrado larvas de la especie únicamente a temperaturas de más de 24°C.

Hay probablemente uno ó dos stocks de pez espada en el OPO, uno con su centro de distribución en el Pacífico sudeste, y posiblemente otro con su centro de distribución frente a California y Baja California. Además, es posible que un stock del Pacífico noroeste se desplace al OPO en varias ocasiones.

Los modelos de producción señalan que las capturas por unidad de esfuerzo (CPUE) de pez espada, aunque han disminuido y luego aumentado recientemente, son todavía mayores que las CPUE que corresponden al rendimiento promedio máximo sostenible. Esta conclusión es provisional, debido particularmente a la incertidumbre actual con respecto a la estructura del stock.

MARLIN AZUL

La mejor información ahora disponible indica que el marlín azul (*Makaira nigricans*) constituye una sola especie a nivel mundial, y que existe un solo stock de la especie en el Océano Pacífico.

El marlín azul es capturado por buques palangreros de muchas naciones que pescan atunes y peces picudos entre aproximadamente 50°N y 50°S (Tabla 4). Pesquerías deportivas y varias pesquerías comerciales de superficie capturan cantidades menores.

Pequeñas cantidades de marlines azules han sido marcadas con marcas convencionales, principalmente por pescadores deportivos. Algunos de estos peces han sido recapturados a grandes distancias del punto de liberación. Además, se han marcado marlines azules con marcas acústicas y se han seguido sus actividades durante períodos cortos.

El marlín azul vive generalmente en regiones con temperaturas superficiales del mar (TSM) de más de 24°C, y pasan un 90% del tiempo a profundidades donde la temperatura es de 1° a 2° diferente a la TSM.

Se usó el modelo de poblaciones con retardos temporales de Deriso y Schnute, una forma de modelo de producción, para evaluar la condición del stock de marlín azul en el Océano Pacífico. Se usaron datos de las capturas anuales totales estimadas para 1951-1997, en toneladas métricas, y tasas de captura estandarizadas elaboradas de datos de captura y esfuerzo de pesca nominal de la pesquería palangrera japonesa de 1955-1997. Se concluyó que el stock de marlín azul en el Pacífico está en condición sana, con los niveles actuales de biomasa y esfuerzo de pesca cercanos a los necesarios para mantener el rendimiento máximo sostenible.

Un análisis más reciente, usando Multifan-CL, fue realizado para evaluar los stocks de marlín azul en el Océano Pacífico y evaluar la eficacia de la estandarización basada en hábitat del esfuerzo palangrero. Existe una incertidumbre considerable con respecto a los niveles de esfuerzo de pesca que producirían el rendimiento máximo sostenible. Sin embargo, se determinó que marlín azul en el Océano Pacífico está casi plenamente explotado, es decir, la población está cerca de la cima de la curva de rendimiento. Se descubrió también que la estandarización del esfuerzo, usando un modelo basado en hábitat, permitió estimar los parámetros dentro de límites razonables y con intervalos de confianza reducidos alrededor de las estimaciones.

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