INTER-AMERICAN TROPICAL TUNA COMMMISSION
COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL

QUARTERLY REPORT—INFORME TRIMESTRAL

April-June 2009—Abril-Junio 2009

HEADQUARTERS AND MAIN LABORATORY—OFICINA Y LABORATORIO PRINCIPAL
8604 La Jolla Shores Drive
La Jolla, California 92037-1508, USA
www.iattc.org

The

QUARTERLY REPORT

April-June 2009

of the

INTER-AMERICAN TROPICAL TUNA COMMISSION

is an informal account, published in English and Spanish, of the current status of the tuna fisheries in the eastern Pacific Ocean in relation to the interests of the Commission, and of the research and the associated activities of the Commission's scientific staff. The research results presented should be regarded, in most instances, as preliminary and in the nature of progress reports.

El

INFORME TRIMESTRAL

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de la

COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL

es un relato informal, publicado en inglés y español, de la situación actual de la pesca atunera en el Océano Pacífico oriental con relación a los intereses de la Comisión, y de la investigación científica y demás actividades del personal científico de la Comisión. Gran parte de los resultados de investigación presentados en este informe son preliminares y deben ser considerados como informes del avance de la investigación.

Editor—Redactor:
William H. Bayliff

INTRODUCTION

The Inter-American Tropical Tuna Commission (IATTC) operates under the authority and direction of a convention originally entered into by Costa Rica and the United States. The convention, which came into force in 1950, is open to adherence by other governments whose nationals fish for tropical tunas and tuna-like species in the eastern Pacific Ocean (EPO). Under this provision Panama adhered in 1953, Ecuador in 1961, Mexico in 1964, Canada in 1968, Japan in 1970, France and Nicaragua in 1973, Vanuatu in 1990, Venezuela in 1992, El Salvador in 1997, Guatemala in 2000, Peru in 2002, Spain in 2003, the Republic of Korea in 2005, and Colombia in 2007. Canada withdrew from the IATTC in 1984.

The IATTC's responsibilities are met with two programs, the Tuna-Billfish Program and the Tuna-Dolphin Program.

The principal responsibilities of the Tuna-Billfish Program specified in the IATTC's convention were (1) to study the biology of the tunas and related species of the eastern Pacific Ocean to estimate the effects that fishing and natural factors have on their abundance and (2) to recommend appropriate conservation measures so that the stocks of fish could be maintained at levels that would afford maximum sustainable catches. It was subsequently given the responsibility for collecting information on compliance with Commission resolutions.

The IATTC's responsibilities were broadened in 1976 to address the problems arising from the incidental mortality in purse seines of dolphins that associate with yellowfin tuna in the EPO. The Commission agreed that it "should strive to maintain a high level of tuna production and also to maintain [dolphin] stocks at or above levels that assure their survival in perpetuity, with every reasonable effort being made to avoid needless or careless killing of [dolphins]" (IATTC, 33rd meeting, minutes: page 9). The principal responsibilities of the IATTC's Tuna-Dolphin Program are (1) to monitor the abundance of dolphins and their mortality incidental to purse-seine fishing in the EPO, (2) to study the causes of mortality of dolphins during fishing operations and promote the use of fishing techniques and equipment that minimize these mortalities, (3) to study the effects of different modes of fishing on the various fish and other animals of the pelagic ecosystem, and (4) to provide a secretariat for the International Dolphin Conservation Program, described below.

On 17 June 1992, the Agreement for the Conservation of Dolphins ("the 1992 La Jolla Agreement"), which created the International Dolphin Conservation Program (IDCP), was adopted. The main objective of the Agreement was to reduce the mortality of dolphins in the purse-seine fishery without harming the tuna resources of the region and the fisheries that depend on them. This agreement introduced such novel and effective measures as Dolphin Mortality Limits (DMLs) for individual vessels and the International Review Panel to monitor the performance and compliance of the fishing fleet. On 21 May 1998, the Agreement on the International Dolphin Conservation Program (AIDCP), which built on and formalized the provisions of the 1992 La Jolla Agreement, was signed, and it entered into force on 15 February 1999. In 2007 the Parties to this agreement consisted of Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru, the United States, Vanuatu, and Venezuela, and Bolivia, Colombia, and the European Union were applying it provisionally. These were "committed to ensure the sustainability of tuna stocks in the eastern Pacific Ocean and to progressively reduce the incidental mortalities of dolphins in the tuna fishery of the eastern Pacific Ocean to levels approaching zero; to avoid, reduce and minimize the incidental catch and the discard of juvenile tuna and the incidental catch of non-target species, taking into consideration the interrelationship among species in the ecosystem." This agreement established Stock Mortality Limits, which are similar to DMLs except that (1) they apply to all vessels combined, rather than to individual vessels, and (2) they apply to individual stocks of dolphins, rather than to all stocks of dolphins combined. The IATTC provides the Secretariat for the International Dolphin Conservation Program (IDCP) and its various working groups and panels and coordinates the On-Board Observer Program and the Tuna Tracking and Verification System (both described later in this report).

At its 70th meeting, on 24-27 June 2003, the Commission adopted the Resolution on the Adoption of the Convention for the Strengthening of the Inter-American Tropical Tuna Commission Established by the 1949 Convention between the United States of America and the Republic of Costa Rica ("the Antigua Convention"). This convention will replace the original one 15 months after it has been ratified or acceded to by seven Parties that were Parties to the 1949 Convention on the date that the Antigua Convention was open for signature. It has been ratified or acceded to by Mexico on 14 January 2005, El Salvador on 10 March 2005, the Republic of Korea on 13 December 2005, the European Union on 7 June 2006, Nicaragua on 13 December 2006, Belize on 12 June 2007, Panama on 10 July 2007, France on 20 July 2007, Japan on 11 July 2008, and Costa Rica on 27 May 2009. Of these, Costa Rica, El Salvador, France, Japan, Mexico, Nicaragua, and Panama were Parties to the 1949 Convention on the date that the Antigua Convention was open for signature, so it will enter into force on 27 August 2010.

To carry out its responsibilities, the IATTC conducts a wide variety of investigations at sea, in ports where tunas are landed, and in its laboratories. The research is carried out by a permanent, internationally-recruited research and support staff appointed by the Director, who is directly responsible to the Commission.

The scientific program is now in its 57th year. The results of the IATTC staff's research are published in the IATTC's Bulletin and Stock Assessment Report series in English and Spanish, its two official languages, in its Special Report and Data Report series, and in books, outside scientific journals, and trade journals. Summaries of each year's activities are reported upon in the IATTC's Annual Reports and Fishery Status Reports, also in the two languages.

SPECIAL ANNOUNCEMENT

Costa Rica deposited its instrument of ratification of the "Antigua Convention" on May 27, 2009. This convention will replace the 1949 Convention 15 months after it has been ratified or acceded to by seven Parties that were Parties to the 1949 Convention on the date that the Antigua Convention was open for signature. Costa Rica is the seventh nation to do that, the others being Mexico on January 14, 2005, El Salvador on March 10, 2005, Nicaragua on December 13, 2006, Panama on July 10, 2007, France on July 20, 2007, and Japan on July 11, 2008. The United States, as depositary government, has stated that the Antigua Convention will therefore enter into force on August 27, 2010.

MEETINGS

IATTC meetings

The tenth IATTC Stock Assessment Review Meeting was held in La Jolla, California, USA, on 11-15 May 2009. Dr. Guillermo Compeán presided at the meeting, Drs. Robert J. Olson and Daniel Margulies served as rapporteurs, and presentations were made by Drs. Richard B. Deriso, Alexandre Aires-da-Silva, Martín A. Hall, Michael G. Hinton, Cleridy E. Lennert-Cody, Mark N. Maunder, and Robert J. Olson, and Mr. Edward H. Everett,

The following meetings of the IATTC and the IDCP and their working groups were held in La Jolla, California, USA, in June 2009:

Inter-American Tropical Tuna Commission		
Meeting		**Dates**
10	Permanent Working Group on Compliance	5 June 2009
80	Inter-American Tropical Tuna Commission	8-12 June 2009

International Dolphin Conservation Program		
Meeting		**Dates**
26	Permanent Working Group on Tuna Tracking	4 June 2009
13	Working Group to Promote and Publicize the AIDCP Dolphin Safe Tuna Certification System	4 June 2009
47	International Review Panel	4 June 2009
21	Parties to the AIDCP	5 June 2009

IATTC and IDCP		
Meeting		**Date**
8	Joint Working Group on Fishing by Non-Parties	6 June 2009

Four resolutions were adopted at the IATTC meeting; these are available on the IATTC web site under Resolutions.

Other meetings

Mr. Ernesto Altamirano Nieto participated in the 198th session of the Pacific Fishery Management Council (PFMC) of the United States in San Francisco, California, USA, on 2-5 April 2009. He gave a presentation on the status of the tuna fishery and the IATTC's conservation measures in the eastern Pacific Ocean to the Highly Migratory Species (HMS) Advisory Subpanel and the HMS Management Team, both advisory bodies of the PFMC. His expenses were paid by the PFMC.

Dr. Guillermo Compeán participated in the first meeting of the Science Committee of the International Seafood Sustainability Foundation at the Southwest Fisheries Science Center, La Jolla, California, USA, on 14-15 April 2009.

Many members of the IATTC staff attended all or parts of the 60th Tuna Conference in Lake Arrowhead, California, USA, on 18-21 May 2009. Dr. Alexandre Aires-da-Silva and Ms.

JoyDeLee C. Marrow served as co-chairs of the conference, and Dr. William H. Bayliff served as moderator of a session on “Life History Studies.” Talks were given by Drs. Aires-Da-Silva, Daniel Margulies, Mark N. Maunder, and Robert J. Olson, and Mr. Marlon H. Román Verdesota. In addition, research in which Drs. Aires-Da-Silva, Martín J. Hall, Michael G. Hinton, Cleridy E. Lennert-Cody, Mark N. Maunder, and Robert J. Olson, Mr. Vernon P. Scholey, and Mss. Maria C. Santiago and Jeanne B. Wexler had participated was presented by other speakers. Also, Dr. Maunder was one of four participants in a panel discussion entitled “High-Tech Science for Large Pelagics: What Have We Learned and How Should It Be Integrated into Management and Conservation?” and a poster prepared by Dr. Olson and two others was presented.

Dr. Cleridy Lennert-Cody and Mr. Alejandro Pérez Rodríguez participated in a workshop, “Tuna Purse-Seine and Bait Boat Catch Species Composition Derived from Observer and Port Sampled Data,” held at the Institut de Recherche pour le Développement, Centre de Recherche Halieutique, Sète, France, on 15-19 June 2009.

Dr. Robert J. Olson served as chairman of a panel that reviewed the pelagic science research conducted by Pacific Islands Fisheries Science Center (PIFSC) of the U.S. National Marine Fisheries Service. The review took place in Honolulu, Hawaii, USA, on 23-25 June 2009. The research areas included “highly migratory species,” such as tunas and billfishes, cetaceans, sea turtles, fisheries oceanography, ecosystem approaches, and “international science.” Dr. Olson’s expenses were paid by the PIFSC.

DATA COLLECTION

The IATTC had field offices at Las Playas and Manta, Ecuador; Manzanillo and Mazatlan, Mexico; Panama, Republic of Panama; Mayaguez, Puerto Rico, USA; and Cumaná, Venezuela, during the second quarter of 2009.

Personnel at these offices collected 382 length-frequency samples from 252 wells and abstracted logbook information for 246 trips of commercial fishing vessels during the second quarter of 2009.

Also during the second quarter members of the field office staffs placed IATTC observers on 128 fishing trips by vessels that participate in the AIDCP On-Board Observer Program. In addition, 123 IATTC observers completed trips during the quarter, and were debriefed by field office personnel.

THE FISHERY FOR TUNAS AND TUNA-LIKE FISHES IN THE EASTERN PACIFIC OCEAN

Surface fleet and surface catch and catch-per-unit-of-effort statistics

Statistical data for purse-seine and pole-and-line vessels are continuously being collected by personnel at the IATTC’s field stations and processed at its headquarters in La Jolla. As a result, estimates of fisheries statistics with varying degrees of accuracy and precision are available, the most accurate and precise being those made after all available information has been entered into the data base, processed, and verified. The estimates for the current quarter are the most preliminary, while those made six months to a year after monitoring of the fishery are much more accurate and precise. While it may require a year or more to obtain some final information, much of the catch information is processed and available within two to three months of the return of a vessel from a fishing trip.

Fleet statistics

The estimated total carrying capacity of the purse-seine and pole-and-line vessels that are fishing, or are expected to fish, in the eastern Pacific Ocean (east of 150°W; EPO) during 2009 is about 229,600 cubic meters (m^3) (Table 1). The weekly average at-sea capacity for the fleet, for the weekly periods ending 30 March through 28 June, was about 161,500 m^3 (range: 153,900 to 168,700 m^3). The changes of flags and vessel names and additions to and deletions from the IATTC's fleet list during that period are given in Table 2.

Catch and catch-per-unit-of-effort statistics for the purse-seine and pole-and-line fisheries

Catch statistics

The estimated total retained catches of tunas in the EPO during the 1 January-28 June 2009 period, in metric tons (t), were:

Species	**2009**	**2004-2008**			**Weekly average, 2009**
		Average	**Minimum**	**Maximum**	
Yellowfin	130,300	130,100	102,700	169,600	5,200
Skipjack	125,200	129,600	93,300	173,800	5,000
Bigeye	28,100	26,300	19,400	36,000	1,100

Preliminary estimates of the retained catches, by species and by flag of vessel, are shown in Table 3.

Catch-per-unit-of-effort statistics based on vessel logbook abstracts

The logbook data used in the analyses have been obtained with the cooperation of vessel owners and captains. The catch and effort measures used by the IATTC staff are based on fishing trips landing predominantly yellowfin, skipjack, bigeye, and bluefin tuna. The great majority of the purse-seine catches of yellowfin, skipjack, and bigeye are made by vessels with carrying capacities greater than 363 t, and only data for purse seiners with carrying capacities greater than 363 t are included herein for comparisons among years. There are now far fewer pole-and-line vessels than in previous years, so the data for these vessels are combined without regard to size classes. There are no adjustments included for other factors, such as type of set or vessel operating costs and market prices, which might identify whether a vessel was directing its effort toward a specific species.

Preliminary estimates of the catches per unit of effort (CPUEs), expressed as catches per day's fishing by purse seiners, of yellowfin (Table 4), skipjack (Table 5), and bigeye (Table 6) in the EPO during the first quarter of 2009 and the corresponding periods of 2004-2008, in metric tons, were:

Species	Region	2009	2004-2008		
			Average	Minimum	Maximum
Yellowfin	N of 5°N	17.7	10.8	9.0	13.7
	S of 5°N	2.5	5.0	2.8	9.0
Skipjack	N of 5°N	0.8	2.0	1.1	3.5
	S of 5°N	11.5	9.9	7.1	14.0
Bigeye	EPO	1.3	1.7	1.3	2.7

Preliminary estimates of the CPUEs, by pole-and-line vessels, of yellowfin (Table 4) and skipjack (Table 5) in the EPO during the first quarter of 2009 and the corresponding periods of 2004-2008, in metric tons, were:

Species	Region	2009	2004-2008		
			Average	Minimum	Maximum
Yellowfin	EPO	1.6	2.8	1.8	3.8
Skipjack	EPO	0.7	1.6	1.2	1.9

Catch statistics for the longline fishery

The catches of bigeye by longline gear in the EPO during the first and second quarters of 2009 are shown in Table 7. Equivalent data are not available for the other species of tunas, or for billfishes.

Size compositions of the surface catches of tunas

Length-frequency samples are the basic source of data used for estimating the size and age compositions of the various species of fish in the landings. This information is necessary to obtain age-structured estimates of the population for various purposes, including the integrated modeling that the staff has employed during the last several years. The results of such studies have been described in several IATTC Bulletins, its Annual Reports for 1954-2002, its Fishery Status Reports 1-6, and its Stock Assessment Reports 1-9.

Length-frequency samples of yellowfin, skipjack, bigeye, Pacific bluefin, and, occasionally, black skipjack from the catches of purse-seine, pole-and-line, and recreational vessels in the EPO are collected by IATTC personnel at ports of landing in Ecuador, Mexico, Panama, the USA, and Venezuela. The catches of yellowfin and skipjack were first sampled in 1954, bluefin in 1973, and bigeye in 1975. Sampling has continued to the present.

The methods for sampling the catches of tunas are described in the IATTC Annual Report for 2000 and in IATTC Stock Assessment Report 4. Briefly, the fish in a well of a purse-seine or pole-and-line vessel are selected for sampling only if all the fish in the well were caught during the same calendar month, in the same type of set (floating-object, unassociated school, or dolphin), and in the same sampling area. These data are then categorized by fishery (Figure 1).

Data for fish caught during the first quarter of 2004-2009 are presented in this report. Two sets of length-frequency histograms are presented for each species; the first shows the data by stratum (gear type, set type, and area) for the first quarter of 2009, and the second shows the combined data for the first quarter of each year of the 2004-2009 period. Samples from 285 wells were taken during the first quarter of 2009. There were no reported catches made by pole-and-line vessels during the first quarter of 2009.

There are ten surface fisheries for yellowfin defined for stock assessments: four associated with floating objects, two unassociated school, three associated with dolphins, and one pole-and-line (Figure 1). The last fishery includes all 13 sampling areas. Of the 285 wells sampled during the first quarter of 2009, 134 contained yellowfin. The estimated size compositions of these fish are shown in Figure 2a. The majority of the yellowfin catch was taken by sets on schools associated with dolphins in the Northern, Inshore, and Southern areas. Smaller amounts of yellowfin were taken on unassociated schools in the South, and on schools associated with floating objects in the Southern and Inshore areas. There were also small amounts of yellowfin taken in floating-object sets in the Southern area.

The estimated size compositions of the yellowfin caught by all fisheries combined during the first quarter of 2004-2009 are shown in Figure 2b. The average weight of the fish caught during the first quarter of 2009 was significantly greater than those of the previous five years.

There are eight fisheries for skipjack defined for stock assessments: four associated with floating objects, two unassociated school, one associated with dolphins, and one pole-and-line (Figure 1). The last two fisheries include all 13 sampling areas. Of the 285 wells sampled during the first quarter of 2009, 205 contained skipjack. The estimated size compositions of these fish are shown in Figure 3a. A large portion of the skipjack caught during the first quarter was taken in the Southern unassociated fishery. There were also smaller catches of skipjack in the Northern, Equatorial, Inshore, and Southern floating-object fisheries.

The estimated size compositions of the skipjack caught by all fisheries combined during the first quarter of 2004-2009 are shown in Figure 3b. The average weights of skipjack caught during the first quarter of 2009 were equal to those caught in 2004, and greater than those caught during that period of 2005-2008. The 2009 size composition shows two distinct modes of skipjack in the 40- to 50-cm and 55- to 65-cm size ranges.

There are seven surface fisheries for bigeye defined for stock assessments: four associated with floating objects, one unassociated school, one associated with dolphins, and one pole-and-line (Figure 1). The last three fisheries include all 13 sampling areas. Of the 285 wells sampled during the first quarter of 2009, 27 contained bigeye. The estimated size compositions of these fish are shown in Figure 4a. The majority of the catch was taken in floating-object sets in the Equatorial and Southern areas, with smaller catches in the Northern and Inshore floating-object fisheries. The fish caught in the inshore floating-object fishery were quite large, averaging 64.3 kg. (Only four samples for this stratum were obtained. Three of these were based on the contents of wells with small amounts of relatively small bigeye, and the fourth was based on the contents of a well with 85 t of fish, most of which were large bigeye.)

The estimated size compositions of the bigeye caught by all fisheries combined during the first quarter of 2004-2009 are shown in Figure 4b. The average weight of bigeye caught during the first quarter of 2009 was greater than that of 2008 and considerably greater than those of 2004-2007.

Observer program

Coverage

The Agreement on the International Dolphin Conservation Program (AIDCP) requires 100-percent coverage by observers on trips by purse seiners with carrying capacities greater than 363 metric tons that fish for tunas in the eastern Pacific Ocean (EPO). This mandate is carried out by the AIDCP On-Board Observer Program, made up of the IATTC's international observer program and the observer programs of Colombia, Ecuador, the European Union, Mexico, Nicaragua, Panama, and Venezuela. The observers are biologists trained to collect a variety of data on the mortalities of dolphins associated with the fishery, sightings of dolphin herds, catches of tunas and bycatches of fish and other animals, oceanographic and meteorological data, and other information used by the IATTC staff to assess the conditions of the various stocks of dolphins, study the causes of dolphin mortality, and assess the effect of the fishery on tunas and other components of the ecosystem. The observers also collect data relevant to compliance with the provisions of the AIDCP, and data required for the tuna-tracking system established under the AIDCP, which tracks the "dolphin-safe" status of tuna caught in each set from the time it is captured until it is unloaded (and, after that, until it is canned and labeled).

In 2009 the observer programs of Colombia, the European Union, Mexico, Nicaragua, Panama, and Venezuela are to sample half, and that of Ecuador approximately one-third, of the trips by vessels of their respective fleets, while IATTC observers are to sample the remainder of those trips. Except as described in the next paragraph, the IATTC is to cover all trips by vessels registered in other nations that are required to carry observers.

At the fifth meeting of the Parties to the AIDCP in June 2001, observers from the international observer program of the South Pacific Forum Fisheries Agency (FFA) were approved to collect pertinent information for the On-Board Observer Program, pursuant to Annex II (9) of the AIDCP in cases for which the Director determines that the use of an observer from the AIDCP On-Board Observer Program is not practical.

Observers from the On-Board Observer Program departed on 199 fishing trips aboard purse seiners covered by that program during the second quarter of 2009. Preliminary coverage data for these vessels during the quarter are shown in Table8.

Training

There were no IATTC observer training courses conducted during the quarter.

RESEARCH

Tuna tagging

Two IATTC scientists spent the period of 12-26 April 2009, aboard the 28-meter sport-fishing vessel *Royal Star* on a fishing trip to the Revillagigedo Islands Marine Reserve, Mexico, for tagging yellowfin tuna and wahoo. The tagging project is a collaborative effort between the IATTC, the Instituto Nacional de Pesca of Mexico, and the owners of the *Royal Star*. The permit obtained from the government of Mexico for this project provides a unique opportunity to conduct a scientific evaluation of the movements and behavior of yellowfin tuna and wahoo within the Reserve and in areas to which they might move, through no-retention tag-and-release fishing trips aboard the *Royal Star*. The cruise was highly successful, as 631 yellowfin ranging from 44 to 198 cm in length, with an average length of 115 cm, were tagged with conventional dart tags, and an additional 21 yellowfin, ranging in length from 71 to 126 cm, with an average length of 106 cm, were tagged with archival tags. In addition, 98 wahoo were tagged in the water with intra-muscular tags. The estimated weights of these ranged from 2.3 to 27.3 kg, with an average weight of 8.6 kg. More yellowfin tuna were tagged on this cruise than on any of the previous five cruises made to that area since 2006. Four yellowfin weighing more than 300 pounds (136 kg) were tagged with conventional dart tags during this trip. Yellowfin that large are rare in the eastern Pacific Ocean, so if any of these are recaptured the data will be of great value.

Two IATTC scientists spent the period of 12 May-19 June 2009 aboard the Honolulu-based commercial fishing vessel *Double D*, on which they conducted tuna tagging operations in the equatorial central Pacific Ocean. The fish were caught by the "troller-dangler" method, which entails trolling with very short lines and lures (usually plastic squids) with small barbless hooks, so that the fish are brought aboard the vessel in condition as good as those that are caught by baitfishing (as used aboard the *Her Grace*, which has been chartered for tagging in the EPO). The total numbers of tunas tagged and released during this cruise were as follows: bigeye, 2,303; yellowfin, 225; skipjack, 167. Archival tags were used on 80 of the bigeye and 10 of the yellowfin. This tagging cruise was a collaborative effort of the Oceanic Fisheries Programme of the Secretariat of the Pacific Community and the IATTC, within the framework of the Pacific Tuna Tagging Programme, a new program jointly managed by the Western and Central Pacific Fisheries Commission (WCPFC) and the IATTC through a steering committee.

Ecosystem studies

Dr. Shane Griffiths of the Commonwealth Scientific and Industrial Research Organisation of Australia, spent the period of 28 April-28 May 2009 at the IATTC office in La Jolla, where he worked with Drs. Robert J. Olson and George M. Watters of the U.S. National Marine Fisheries Service on a manuscript on wasp-waist controls in pelagic food webs in the eastern Pacific Ocean and off eastern Australia.

Ms. Bridget Ferriss, a Ph.D. candidate at the University of Washington School of Aquatic and Fishery Sciences, spent the period of 23-28 May 2009 working with Dr. Robert J. Olson and Ms. Leanne M. Duffy. She is studying regional variability and oceanographic influences on mercury concentrations in yellowfin and bigeye tuna. (Mercury serves as an ecological indicator of trophic structure, depth of feeding, *etc*.) During her stay in La Jolla, she took subsamples from white-muscle tissue samples of yellowfin and bigeye that had been collected in the eastern Pacific Ocean by observers from Ecuador and Mexico.

Early life history studies

Yellowfin broodstock

The yellowfin broodstock in Tank 1 (1,362,000 L) at the Achotines Laboratory spawned daily during the quarter, after resuming spawning on 10 April as the water temperature in the tank increased. Spawning occurred between 6:15 p.m. and 10:50 p.m. The numbers of eggs collected after each spawning event ranged from about 13,000 to 1,405,000. The water temperatures in the tank during the quarter ranged from 22.4° to 29.0°C, and spawning occurred at water temperatures of 24.0° to 29.0°C.

There were two 52- to 53-kg yellowfin and seven 24- to 30-kg yellowfin in Tank 1 at the end of June..

In late January 2007, 10 yellowfin (4 to 10 kg) held in the 170,000-L reserve broodstock tank (Tank 2) were implanted with prototype archival tags and transferred to Tank 1. Another 15 reserve-broodstock yellowfin held in Tank 2 were transferred to Tank 1 during late 2008; 5 of the October-stocked fish and 1 of the December-stocked fish were implanted with archival tags before they were moved to Tank 1. At the end of June, two of the January 2007 group and three of the October 2008 group, all bearing archival tags, remained in Tank 1.

Workshop on physiology and aquaculture of pelagic fishes

The IATTC and the University of Miami held their seventh workshop, "Physiology and Aquaculture of Pelagics, with Emphasis on Reproduction and Early Developmental Stages of Yellowfin Tuna," on June 8-20, 2009. The organizers were Dr. Daniel Margulies and Mr. Vernon P. Scholey of the IATTC staff and Dr. Daniel Benetti, Director of the Aquaculture Program of the Rosenstiel School of Marine and Atmospheric Science, University of Miami. Mr. Scholey and Dr. Benetti served as instructors. The participants were Mr. Alex Muhlholzl of Oceanic Tuna, Scotland, Mr. John Hutapea of the Gondol Research Center for Mariculture, Indonesia, Ms. Francesca Forrestal, Mr. Todd Glodek, and Mr. Kevin Polk, graduate students of Dr. Benetti at the University of Miami, and Dr. Gavin Partridge, a University of Miami post-doctoral student. A fee for the participants covered the expenses of putting on the workshop. As part of the workshop, yellowfin larvae and juveniles were cultured from the egg stage through the fourth week of feeding. (Some larval cultures had been initiated prior to the beginning of the workshop.)

Rearing of yellowfin eggs, larvae, and juveniles

During the quarter, the following parameters were recorded for most spawning events: times of spawning, egg diameter, duration of egg stage, hatching rate, lengths of hatched larvae, and duration of yolk-sac stage. The weights of the eggs, yolk-sac larvae, and first-feeding larvae, and the lengths and selected morphometrics of these, were measured periodically.

The fish from several spawnings were used for rearing and experimental trials during the quarter. These trials are described below.

Experiments with yellowfin tuna larvae

Early life history group trials

During the quarter an experiment was conducted to examine the effect of different stocking densities on growth of 9- to 15-day-old yellowfin tuna larvae that were fed at high food levels. Despite a 4-fold difference in density between replicate tanks of the lowest and highest densities, there were no significant differences in growth rates (*P*>0.30) or in mean sizes at age between the two groups (*P*>0.10). Similar results were obtained in an experiment conducted in 2008, for which larvae between 8 and 15 days old were also fed at high food levels, but were maintained in smaller tanks (IATTC Quarterly Report for October-December 2008).

Different results were obtained in an experiment conducted in 2001 (IATTC Quarterly Report for April-June 2001) for larvae of a similar age range that were fed at lower food levels. The growth rates ($P = 0.001$) and mean sizes at age ($P<0.01$) were significantly higher for larvae stocked at the lower densities. The lower food levels in the 2001 experiment probably reflect natural conditions in the ocean more closely than do the higher food levels used in the 2008 and 2009 experiments. Nonetheless, it appears that density-dependent growth during this stage of development (*i.e.* 8-15 days after hatching) may be influenced by food concentration and availability. During the first week of feeding (approximately 3 to 9 days after hatching), yellowfin larval growth is strongly affected by stocking densities, regardless of food levels (IATTC Quarterly Report for October-December 2008). Further experiments will be conducted to examine stage-specific effects of fish density and food availability on growth for yellowfin larvae more than 8 days old.

Trials for the seventh annual IATTC–University of Miami Workshop

In addition to hands-on learning of standard larval tuna rearing protocols, the participants in the workshops select several areas of interest and carry out short-term trials during the workshops. During the 2009 workshop these areas of interest included attempts to improve growth and survival of larval tuna with extended photoperiods, varying turbulence, and simulating upwelling conditions in several culture tanks. Attempts to wean larval and juvenile tuna onto artificial diets were also carried out.

Global Royal Fish trials

Plans for joint research by the IATTC and Global Royal Fish (GRF) are described in the IATTC Quarterly Report for January-March 2009. Late in the second quarter, GRF scientists initiated several trials with Achotines Laboratory staff members designed to increase the growth and survival of larval and juvenile yellowfin tuna. These trials will be continued through the third quarter of 2009.

Studies of snappers

The work on spotted rose snappers (*Lutjanus guttatus*) is carried out by the Autoridad de los Recursos Acuáticos de Panamá (ARAP).

During the second quarter the mature fish in Tank 3 (85,000 L) experienced high mortality due to the stress caused by the low water temperatures that occurred during February and March in the broodstock tank. By the end of the second quarter, all eight fish had died.

The new population of mature snappers acclimated in Tank 4 (85,000 L) also experienced high mortality due to low water temperatures, and the remaining 18 fish had died by the end of the quarter.

Visitors at the Achotines Laboratory

Dr. Gidon Minkoff, an aquaculture consultant to Global Royal Fish (GRF), spent the period of 23 April-11 May 2009 at the Achotines Laboratory, where he helped coordinate GRF-funded infrastructure upgrades for the Achotines Laboratory and initiate the preliminary research trials with yellowfin tuna larvae described above. Dr. Minkoff returned to the Achotines Laboratory on 20 June 2009.

The Israeli Ambassador to Panama, The Honorable Menashe Bar-On, visited the Achotines Laboratory on 30 April 2009.

Mr. Juan Manuel Ezcurra, Associate Curator of Elasmobranchs at the Monterey Bay Aquarium, Monterey, California, USA, and Mr. Mauro Tambella, Aquarium Director at the Fundación Temaiken in Buenos Aires, Argentina, visited the Achotines Laboratory on 29-30 May 2009.

Dolphins

Estimates of the mortality of dolphins due to fishing

A preliminary estimate of the incidental mortality of dolphins in the fishery in 2008 is 1,171 animals (Table 9), a 39.7 percent increase relative to the 838 mortalities recorded in 2007. The estimated mortalities for 1979-2008, by species and stock, are shown in Table 10 and the standard errors of these estimates are shown in Table 11. The estimates for 1979-1992 are based on a mortality-per-set ratio. The estimates for 1993-1994 are based on the sums of the IATTC species and stock tallies and the total dolphin mortalities recorded by the Mexican program, prorated to species and stock. The estimated mortalities for 1995-2007 represent the sums of the observed species and stock tallies recorded by the IATTC and national programs. The estimates for 2001-2003 have been adjusted for unobserved trips of vessels with carrying capacities greater than 363 metric tons. The sums of the estimated mortalities for the northeastern and western-southern stocks of offshore spotted dolphins are not necessarily equal to those for the previous stocks of northern and southern offshore dolphins because the estimates for the two stock groups are based on different areal strata, and the mortalities per set and the total numbers of sets vary spatially. The mortalities of the principal dolphin species affected by the fishery show declines since the early 1990s (Figure 5) similar to that for the mortalities of all dolphins combined (Figure 6). Estimates of the abundances of the various stocks of dolphins and the relative mortalities (mortality/abundance) are also shown in Table 9. The stock with the highest level of relative mortality (0.06 percent) was eastern spinner dolphin.

The number of sets on dolphin-associated schools of tuna made by vessels with carrying capacities greater than 363 metric tons increased by 3.7 percent, from 8,871 in 2007 to 9,201 in 2008, and this type of set accounted for 42 percent of the total number of sets made by such vessels in 2008, compared to 40 percent in 2009. The average mortality per set increased from 0.09 dolphins in 2007 to 0.13 dolphins in 2008. The trends in the total mortality, numbers of sets on dolphin-associated fish, and mortality per set in recent years are shown in Figure 6.

The catches of dolphin-associated yellowfin increased by 23 percent in 2008 relative to 2007. The percentage of the catch of yellowfin taken in sets on dolphins increased from 61 percent of the total catch in 2007 to 70 percent of the total catch in 2008, and the average catch of yellowfin per set on dolphins increased from 11.7 to 13.9 metric tons. The mortality of dolphins per metric ton of yellowfin caught increased from 0.0081 in 2007 to 0.0092 in 2008.

Causes of the mortality of dolphins

The above figures are based on data from trips covered by observers from all components of the On-Board Observer Program. The comparisons in the next paragraph are based on the IATTC data bases for 1986-2008 only.

The decrease in the mortality per set is the result of actions by the fishermen to better manage the factors that bring about incidental mortalities of dolphins. Indicative of this effort is the number of sets in which no mortalities occurred, which has increased from 38 percent in 1986 to 92 percent in 2008, and the average number of animals left in the net after backdown, which has decreased from 6.0 in 1986 to less than 0.1 in 2008 (Table 12). The factors under the control of the fishermen that are likely to affect the mortality of dolphins per set include the occurrence of malfunctions, especially those that lead to net canopies and net collapses, and the time it takes to complete the backdown maneuver (Table 12). The percentage of sets with major mechanical malfunctions has decreased from an average of approximately 11 percent during the late 1980s to less than 6 percent during 1998-2008; during the same period the percentage of sets with net collapses decreased from about 30 percent to less than 5 percent and that of net canopies from about 20 percent to less than 5 percent. Although the chance of dolphin mortality increases with the duration of the backdown maneuver, the average backdown time has changed little since 1986. Also, the mortality of dolphins per set increases with the number of animals in the encircled herd, in part because the backdown maneuver takes longer to complete when larger herds are encircled. The fishermen could reduce the mortalities per set by encircling schools of fish associated with fewer dolphins.

Other research

IATTC staff members continue to work with scientists from several research institutions and national observer programs on developing statistical techniques to be used to screen for data quality. These techniques can be applied to past years' data as one of several tools used by the IATTC staff to ensure data quality. In collaboration with scientists from the U.S. National Marine Fisheries Service and the University of Hawaii, IATTC staff members have been testing hypotheses about the association of tuna and dolphins. Combining the results of a simultaneous tracking study of yellowfin tuna and spotted dolphins, of food habits studies of tunas and dolphins, and of a study of the relationship of the occurrence of the tuna-dolphin association with oceanographic features allowed these scientists to test whether the association was based on feeding advantages or on reducing the risk of predation. Their results indicated that the predation-risk hypothesis is a more likely explanation than the feeding-benefits hypothesis.

Distribution of fishing effort

The spatial distribution of sets on tunas associated with dolphins in 2008 by vessels carrying observers is shown in Figure 7

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Oceanography and meteorology

Easterly surface winds blow almost constantly over northern South America, which cause upwelling of cool, nutrient-rich subsurface water along the equator east of 160ºW, in the coastal regions off South America, and in offshore areas off Mexico and Central America. El Niño events are characterized by weaker-than-normal easterly surface winds, which cause above-normal sea-surface temperatures (SSTs) and sea levels and deeper-than-normal thermoclines over much of the tropical eastern Pacific Ocean (EPO). In addition, the Southern Oscillation Indices (SOIs) are negative during El Niño episodes. (The SOI is the difference between the anomalies of sea-level atmospheric pressure at Tahiti, French Polynesia, and Darwin, Australia. It is a measure of the strength of the easterly surface winds, especially in the tropical Pacific in the Southern Hemisphere.) Anti-El Niño events, which are the opposite of El Niño events, are characterized by stronger-than-normal easterly surface winds, below-normal SSTs and sea levels, shallower-than-normal thermoclines, and positive SOIs. Two additional indices, the NOI* (Progress Ocean., 53 (2-4): 115-139) and the SOI*, have recently been devised. The NOI* is the difference between the anomalies of sea-level atmospheric pressure at the North Pacific High (35°N-130°W) and Darwin, Australia, and the SOI* is the difference between the anomalies of sea-level atmospheric pressure at the South Pacific High (30°S-95°W) and Darwin. Ordinarily, the NOI* and SOI* values are both negative during El Niño events and positive during anti-El Niño events.

The SSTs in the EPO were mostly below normal from about August 2007 to February 2008, but in March 2008 a small area of warm water appeared along the equator east of 100°W (IATTC Quarterly Report for January-March 2008: Figure 8), and it persisted throughout the second and third quarters. It extended as far west as about 150°W in July, but had retreated to about 115°W by September (IATTC Quarterly Report for July-September 2008: Figure 5). The SSTs were near normal throughout the fourth quarter of 2008, with only a few scattered areas, mostly small, of warm or cool water (IATTC Quarterly Report for October-December 2008: Figure 6). A band of cool water formed along the equator from about 110°W to about 180° in January 2009. It weakened in February, but then became stronger in March, extending from the coast to about 140°W (IATTC Quarterly Report for January-March 2009: Figure 8). It can be seen in Table ocean1 that all of the SST values for the fourth and first quarters were below normal, that the SOI* and NOI* indices, with one exception, were well above normal during the fourth and first quarters, and that the thermocline was very shallow in the equatorial eastern Pacific Ocean from December through March, all of which are indicative of anti-El Niño conditions. (However, the SOI indices were close to normal from October through March, and the charts from which Figure 8 of the IATTC Quarterly Report for January-March 2009 was taken and the equivalent charts for October 2008 through February 2009 indicate, for the most part, near-normal conditions.) During the second quarter of 2009, the SSTs were mostly above normal (Figure ocean1; Table ocean1), the depth of the thermocline increased (Table ocean1), and the sea levels at Callao, Peru, were above normal (Table ocean1). Also, in June, the SOI, SOI*, and NOI* were all below normal (Table ocean1). According to the Climate Diagnostics Bulletin of the U.S. National Weather Service for June 2009, "Current conditions and recent trends favor the continued development of a weak-to-moderate strength El Niño into the Northern Hemisphere fall [of] 2009, with further strengthening possible thereafter."

GEAR PROJECT

During the second quarter the IATTC staff did not participate in any dolphin safety-gear inspections or safety-panel alignment procedures aboard purse seiners.

COLLECTION OF AT-SEA AND SUPPLEMENTAL RETAINED CATCH DATA FOR SMALL PURSE SEINERS

The U.S. National Oceanic and Atmospheric Administration awarded the IATTC a contract, beginning in January 2006, to place observers, on a voluntary basis, on sufficient numbers of trips of "Class-5" purse seiners (vessels with carrying capacities of 273-363 metric tons) based in ports on the Pacific Coast of Latin America to obtain data on "catch, bycatch, interaction with protected species, and gear" for 1,000 days at sea per year and to "sample 100 percent of the in-port unloadings of Class 4-5 purse seine vessels [vessels with well capacities of 182-363 metric tons]." If that were not possible, observers could be placed on sufficient numbers of trips of Class-3 and/or -4 vessels (vessels with well capacities of 92-272 metric tons) to bring the total numbers of days at sea observed to 1,000.

No observers were placed on vessels during the second quarter. The numbers of trips completed, numbers of samples taken, and numbers of fish sampled were as follows:

Month	Trips completed	Samples taken	Fish sampled		
			Yellowfin	Skipjack	Bigeye
April	22	17	4,096	1,200	35
May	25	19	4,761	1,048	50
June	-	-	-	-	-
Total	47	36	8,857	2,248	85

The contract ended on 31 May 2009.

INTER-AGENCY COOPERATION

Mr. Nickolas W. Vogel spent the period of 22-24 April 2009, in Mazatlán, Mexico, where he worked with staff members of the Mexican national observer program to install and demonstrate the use of data bases and data entry and editing programs used to process observer data. Beginning in 2009, the Mexican national observer program began using the data base structures and data entry and editing routines used by the IATTC and the other national observer programs. They will be performing data entry and editing in both their Ensenada and Mazatlan offices.

PUBLICATIONS

IATTC

Status of the tuna and billfish stocks in 2007. Inter-Amer. Trop. Tuna Comm., Stock Assess. Rep., 9: 221 pp.

Outside journals

Maury, Olivier, Patrick Lehodey, Rory Wilson, Frédéric Ménard, Bob Olson, and Jock Young. 2009. Three important CLIOTOP events in 2009. GLOBEC International Newsletter, 15 (1): 20-21.

Wang, Sheng-Ping, Mark N. Maunder, Alexandre Aires-da-Silva, and William H. Bayliff. 2009. Evaluating fishery impacts: application to bigeye tuna (*Thunnus obesus*) in the eastern Pacific Ocean. Fish. Res., 99 (2): 106-111.

Watson, Jordan T., Timothy E. Essington, Cleridy E. Lennert-Cody, and Martín A. Hall. 2009. Trade-offs in the design of fishery closures: management of silky shark bycatch in the eastern Pacific Ocean tuna fishery. Conser. Biol., 23 (3): 626-635.

Chapter in book

Schaefer, Kurt M., Daniel W. Fuller, and Barbara A. Block. 2009. Vertical movements and habitat utilization of skipjack (*Katsuwonus pelamis*), yellowfin (*Thunnus albacares*), and bigeye (*Thunnus obesus*) tunas in the equatorial eastern Pacific Ocean, ascertained through archival tag data. *In* Nielsen, Jennifer L., Haritz Arrizabalaga, Nuno Fragoso, Alistair Hobday, Molly Lutcavage, and John Sibert (editors), 2009, Tagging and Tracking of Marine Animals with Electronic Devices. Springer: 121-144.

ADMINISTRATION

Mr. Ricardo de Ycaza, who had worked as a biologist at the IATTC's Achotines Laboratory since 9 July 2008, resigned on 30 April 2009.

The contract that the IATTC had had with the U.S. National Oceanic and Atmospheric Administration since 2006 to place observers on small purse seiners and to sample the size compositions of their catches ended on 31 May 2009. Mr. Francisco Robayo, who was hired at the Manta, Ecuador, field office in November 2007 to work on that project, was let go on 30 June 2009.

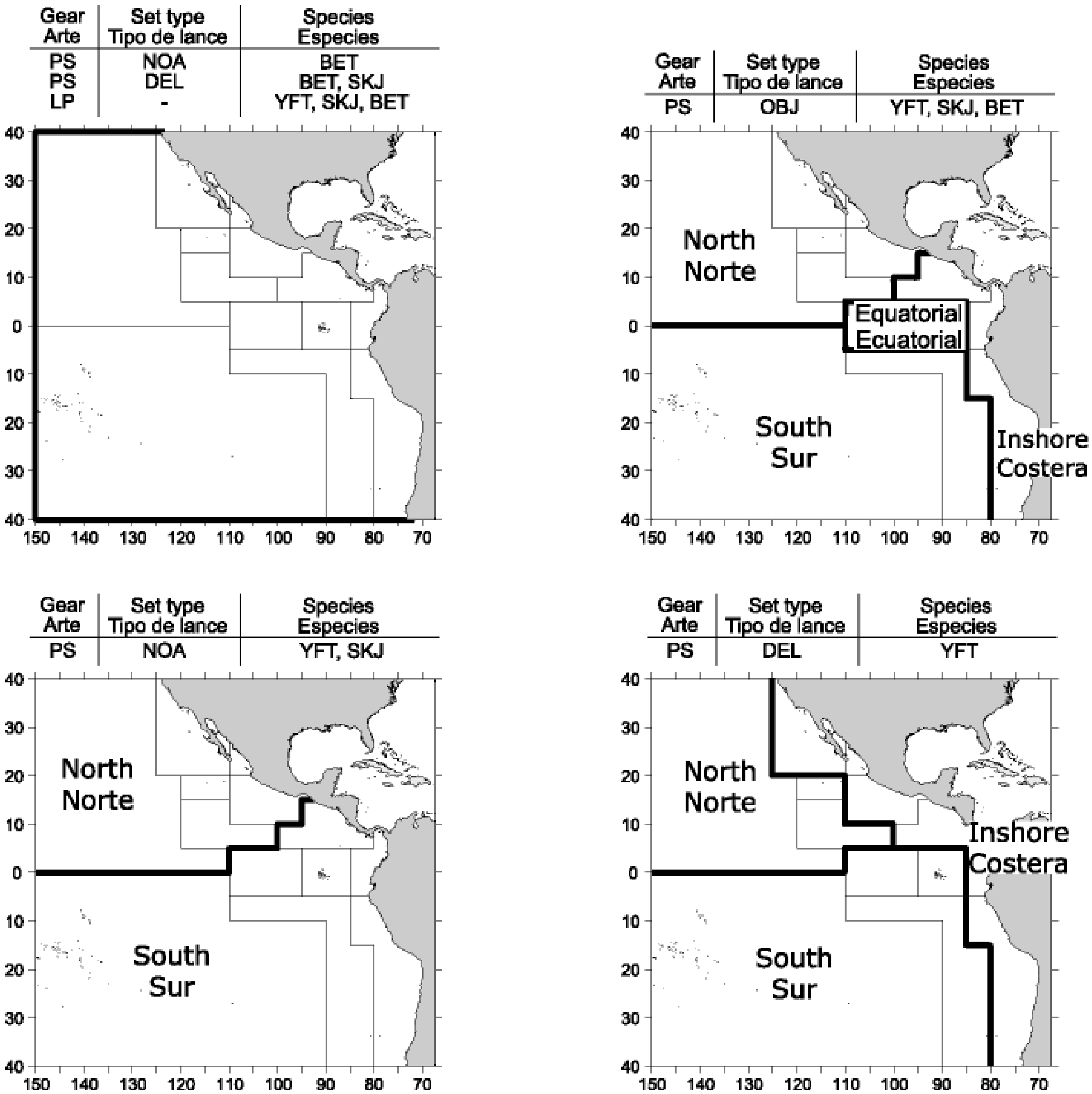

FIGURE 1. Spatial extents of the fisheries defined by the IATTC staff for stock assessment of yellowfin, skipjack, and bigeye in the EPO. The thin lines indicate the boundaries of the 13 length-frequency sampling areas, and the bold lines the boundaries of the fisheries. Gear: PS = purse seine, LP = pole and line; Set type: NOA = unassociated, DEL = dolphin, OBJ = floating object; Species: YFT = yellowfin, SKJ = skipjack, BET = bigeye.

FIGURA 1. Extensión espacial de las pesquerías definidas por el personal de la CIAT para la evaluación de las poblaciones de atún aleta amarilla, barrilete, patudo, y aleta azul en el OPO. Las líneas delgadas indican los límites de las 13 zonas de muestreo de frecuencia de tallas, y las líneas gruesas los límites de las pesquerías. Artes: PS = red de cerco, LP = caña; Tipo de lance: NOA = no asociado, DEL = delfín; OBJ = objeto flotante; Especies: YFT = aleta amarilla, SKJ = barrilete, BET = patudo.

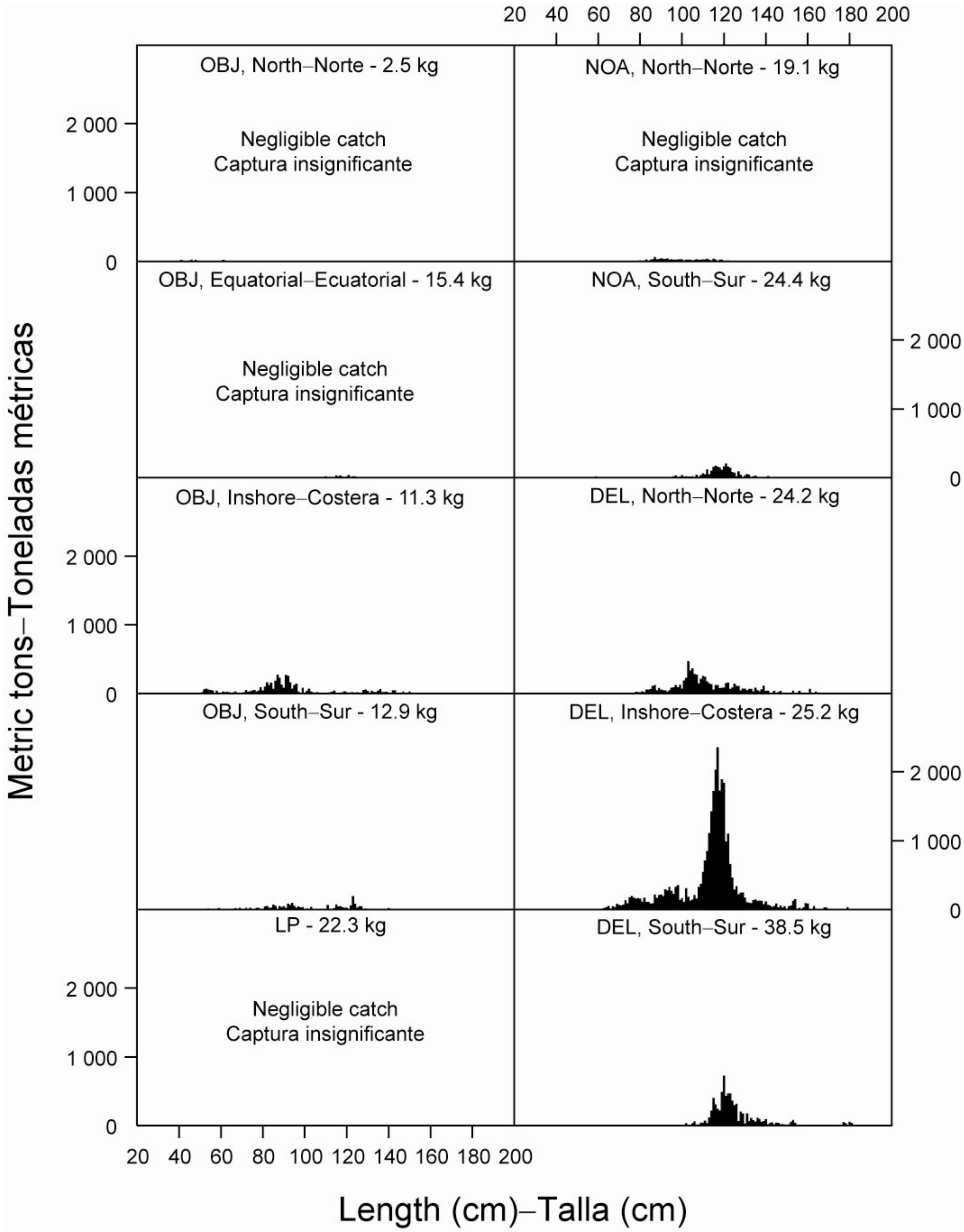

FIGURE 2a. Estimated size compositions of the yellowfin caught in each fishery of the EPO during the first quarter of 2009. The average weights of the fish in the samples are given at the tops of the panels. OBJ = floating object; LP = pole and line; NOA = unassociated; DEL = dolphin.

FIGURA 2a. Composición por tallas estimada para el aleta amarilla capturado en cada pesquería del OPO durante el primer trimestre de 2009. En cada recuadro se detalla el peso promedio de los peces en las muestras. OBJ = objeto flotante; LP = caña; NOA = No asociados; DEL = delfín.

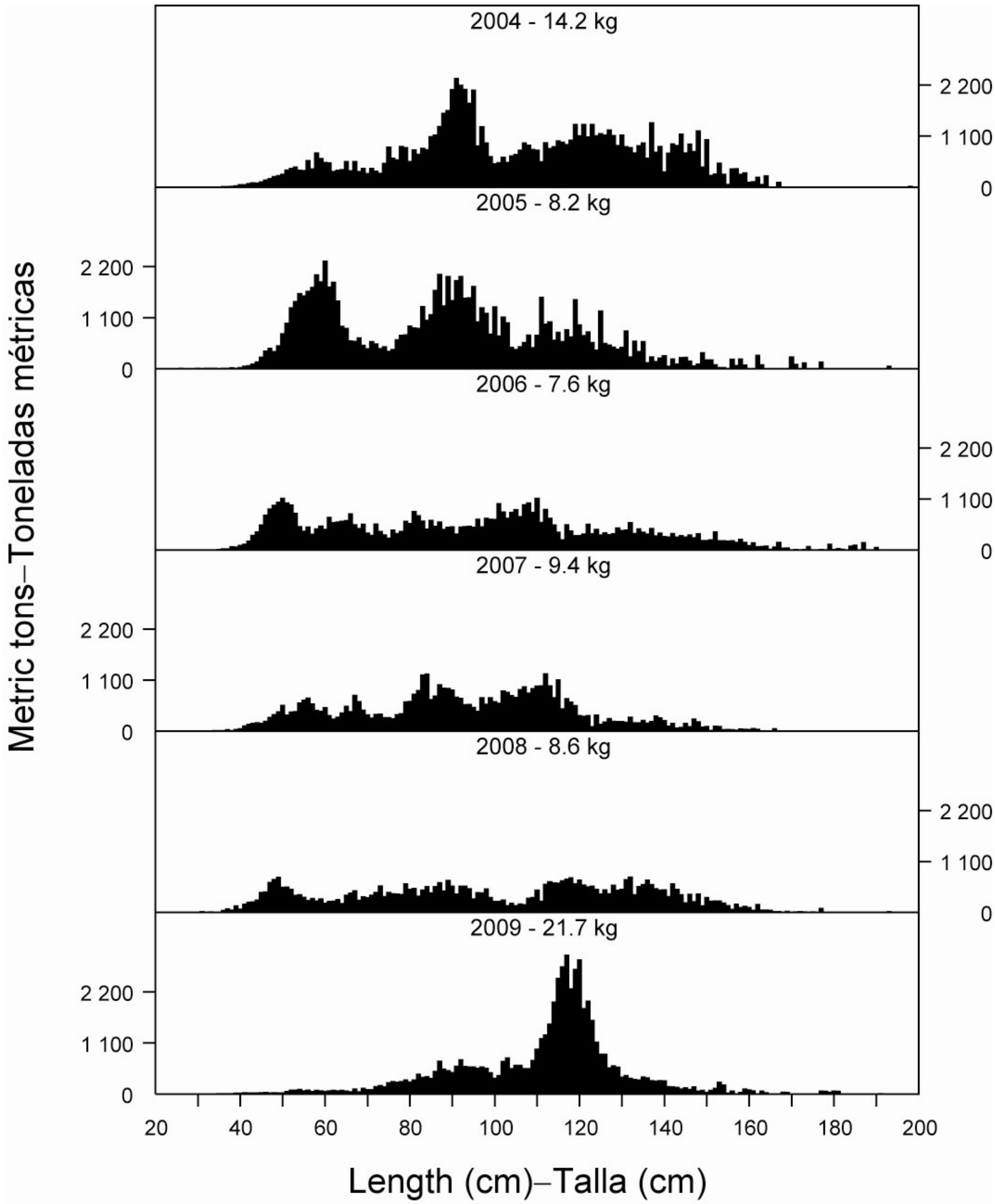

FIGURE 2b. Estimated size compositions of the yellowfin caught in the EPO during the first quarter of 2004-2009. The average weights of the fish in the samples are given at the tops of the panels.

FIGURA 2b. Composición por tallas estimada para el aleta amarilla capturado en el OPO en el primer trimestre de 2004-2009. En cada recuadro se detalla el peso promedio de los peces en las muestras.

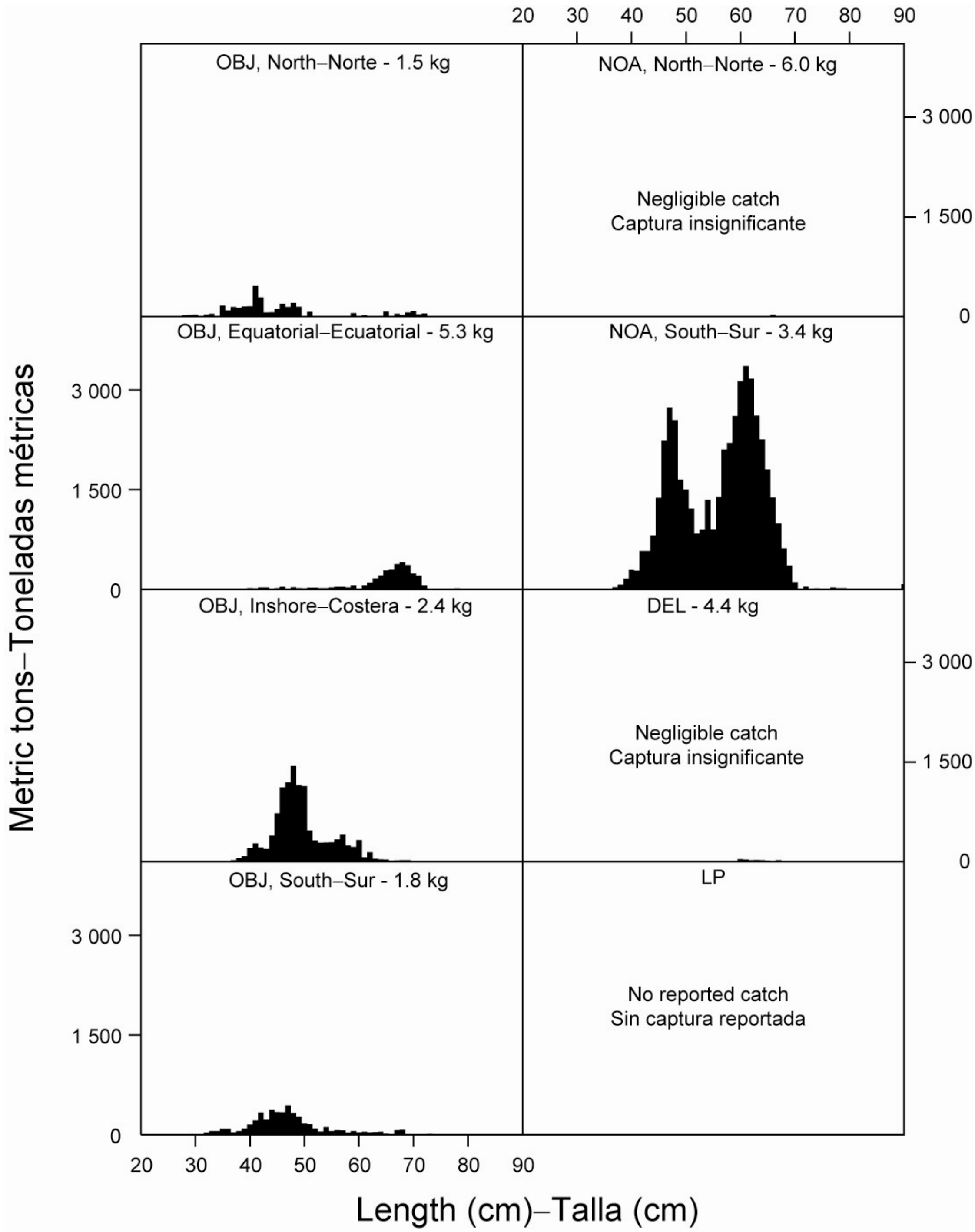

FIGURE 3a. Estimated size compositions of the skipjack caught in each fishery of the EPO during the first quarter of 2009. The average weights of the fish in the samples are given at the tops of the panels. OBJ = floating object; LP = pole and line; NOA = unassociated; DEL = dolphin.

FIGURA 3a. Composición por tallas estimada para el barrilete capturado en cada pesquería del OPO durante el primer trimestre de 2009. En cada recuadro se detalla el peso promedio de los peces en las muestras. OBJ = objeto flotante; LP = caña; NOA = No asociados; DEL = delfín.

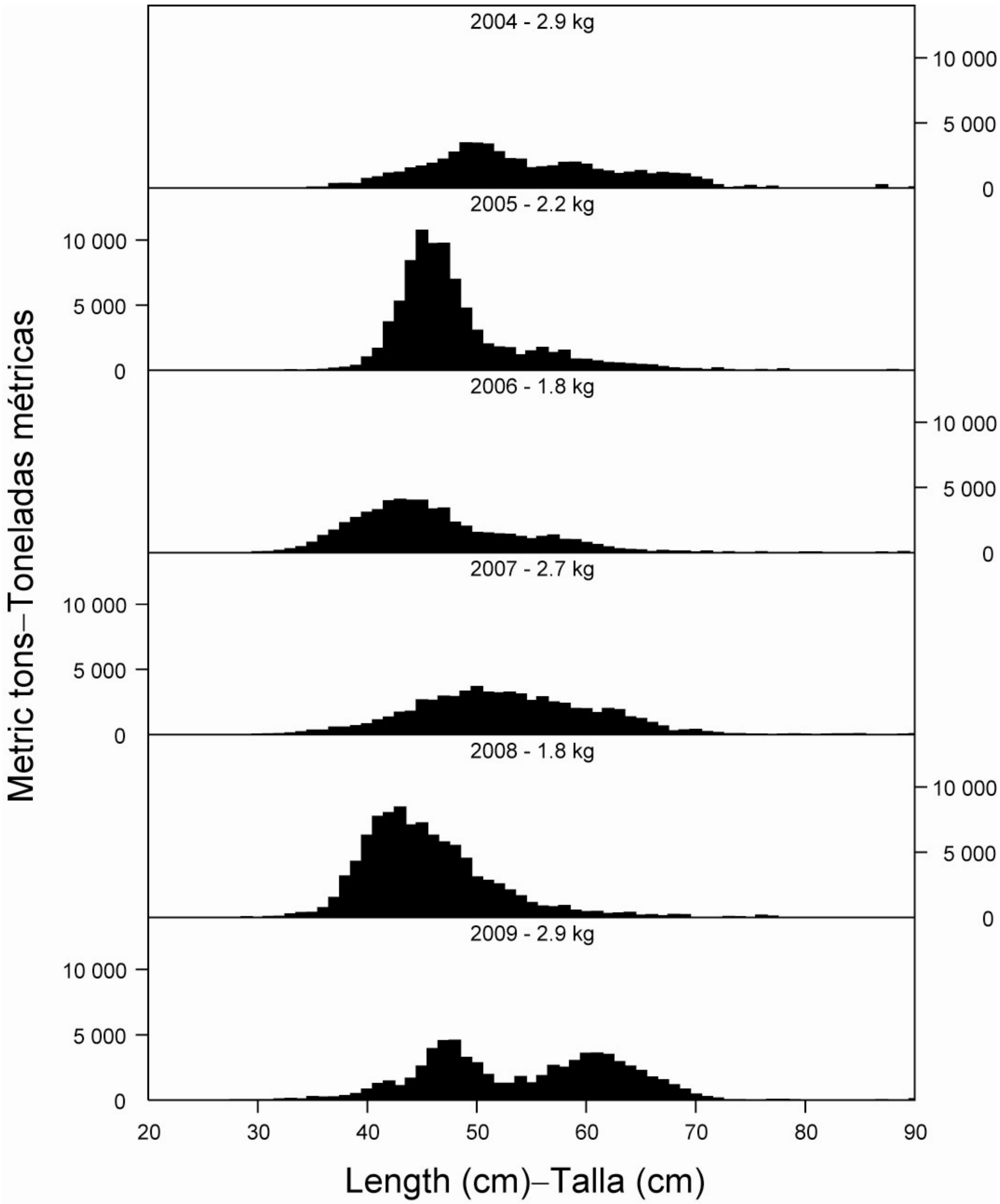

FIGURE 3b. Estimated size compositions of the skipjack caught in the EPO during the first quarter of 2004-2009. The average weights of the fish in the samples are given at the tops of the panels.

FIGURA 3b. Composición por tallas estimada para el barrilete capturado en el OPO en el cuarto trimestre de 2004-2009. En cada recuadro se detalla el peso promedio de los peces en las muestras.

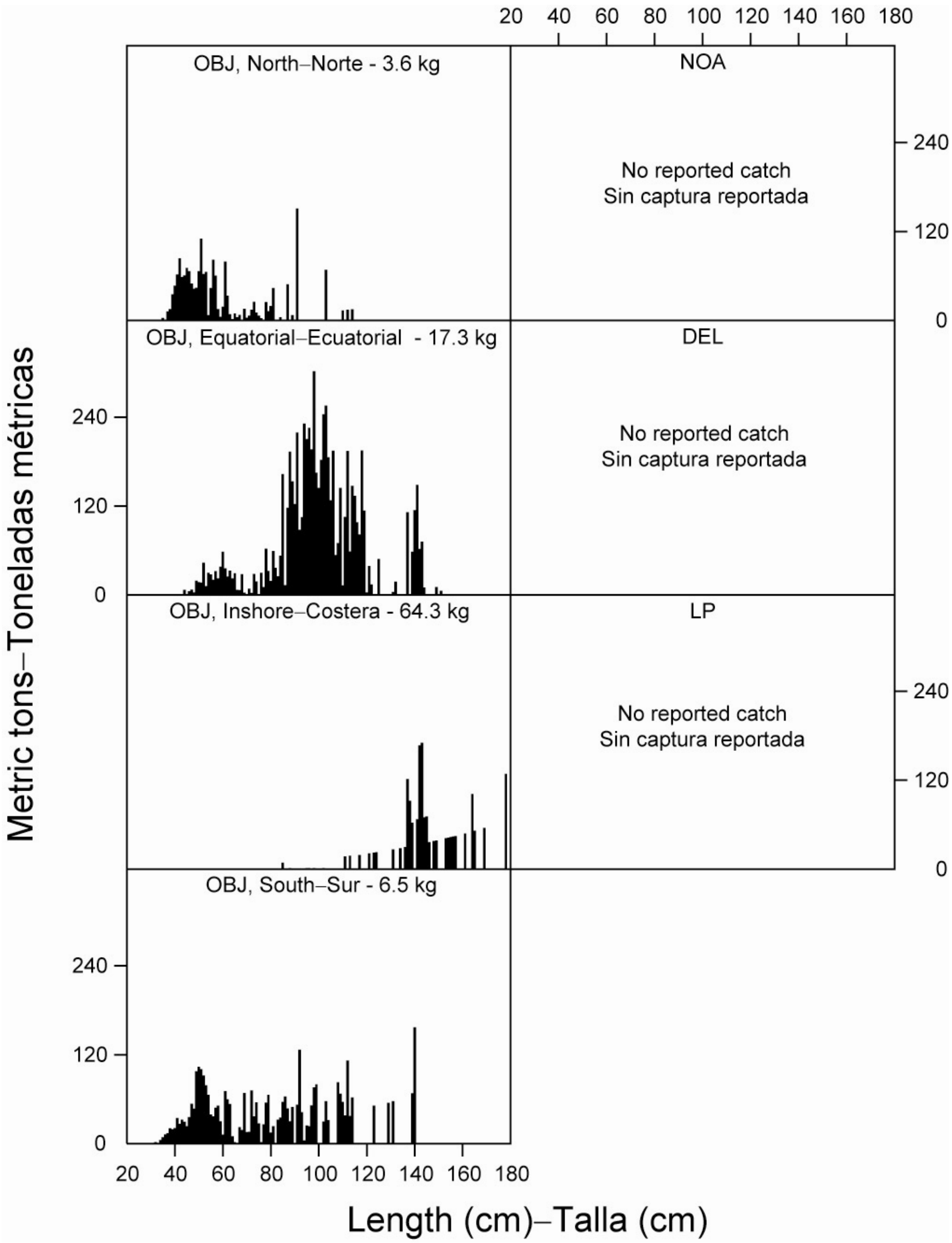

FIGURE 4a. Estimated size compositions of the bigeye caught in each fishery of the EPO during the first quarter of 2009. The average weights of the fish in the samples are given at the tops of the panels. OBJ = floating object; LP = pole and line; NOA = unassociated; DEL = dolphin.

FIGURA 4a. Composición por tallas estimada para el patudo capturado en cada pesquería del OPO durante el primer trimestre de 2009. En cada recuadro se detalla el peso promedio de los peces en las muestras. OBJ = objeto flotante; LP = caña; NOA = No asociados; DEL = delfín.

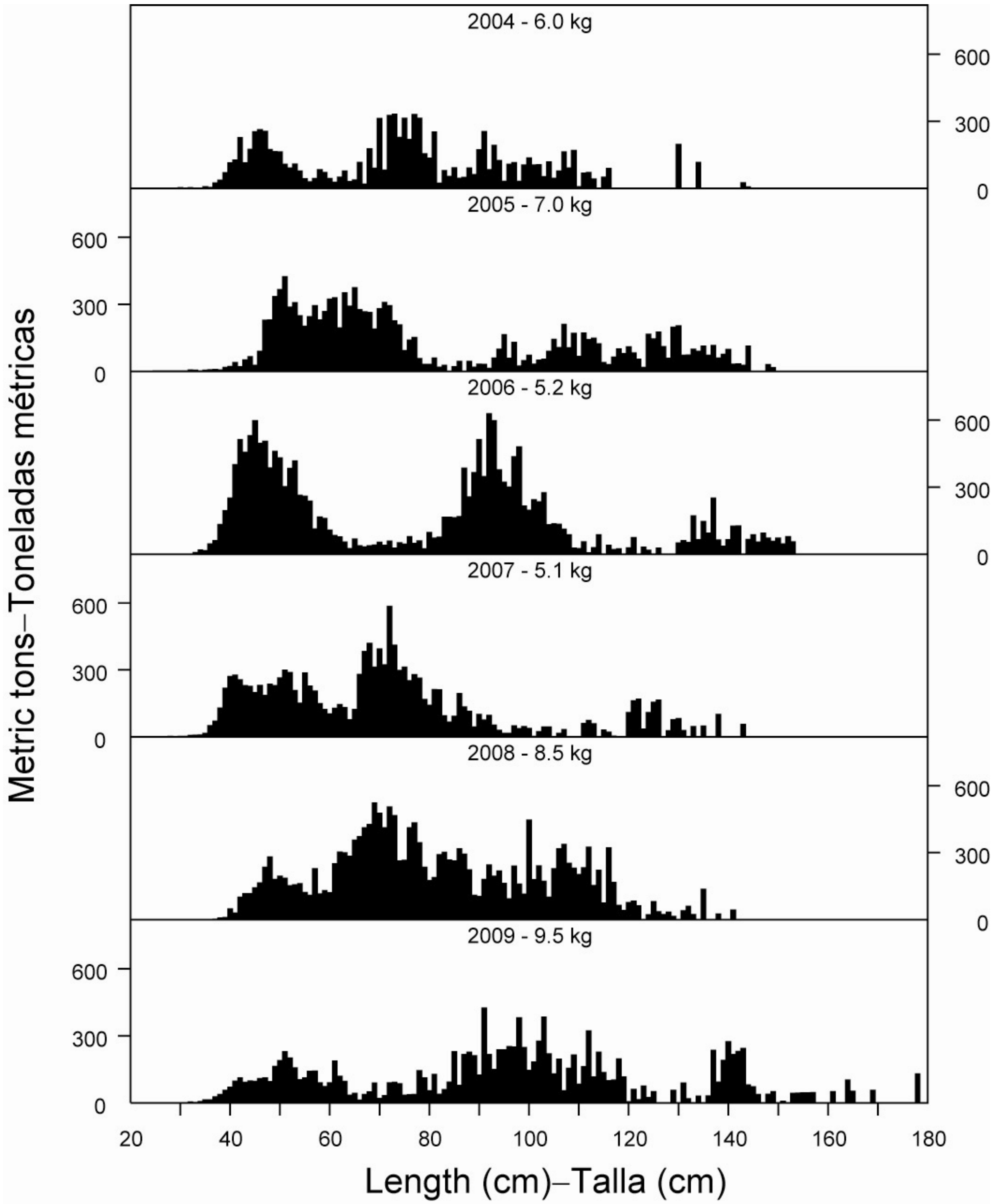

FIGURE 4b. Estimated size compositions of the bigeye caught in the EPO during the first quarter of 2004-2009. The average weights of the fish in the samples are given at the tops of the panels.

FIGURA 4b. Composición por tallas estimada para el patudo capturado en el OPO en el primer trimestre de 2004-2009. En cada recuadro se detalla el peso promedio de los peces en las muestras.

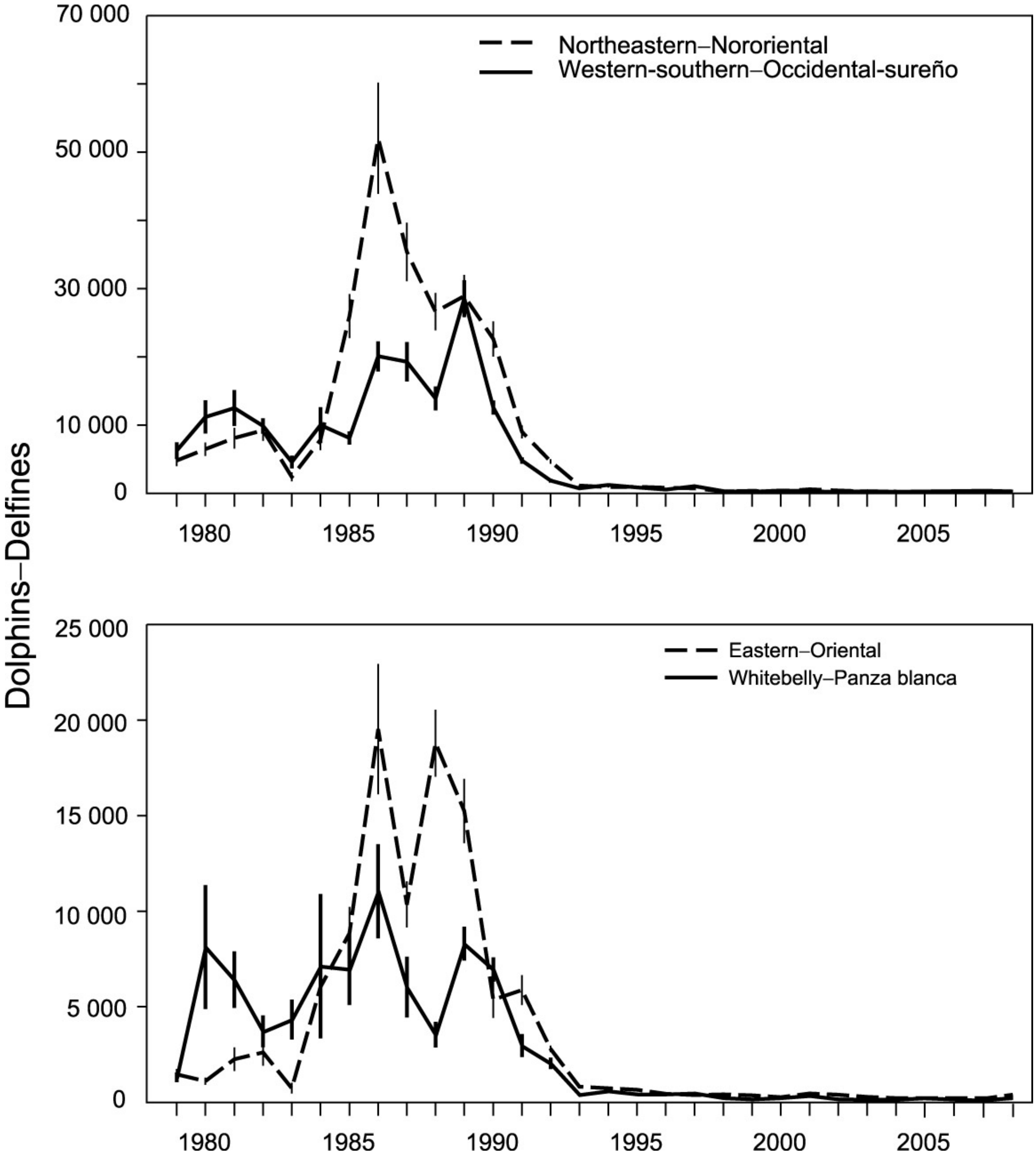

FIGURE 5. Estimated mortalities for the stocks of spotted (upper panel) and spinner (lower panel) dolphins in the eastern Pacific Ocean, 1979-2007. Each vertical line represents one positive and one negative standard error.

FIGURA 5. Mortalidad estimada de las poblaciones de delfines manchados (panel superior) y tornillo (panel inferior) en el Océano Pacífico oriental, 1979-2007. Cada línea vertical representa un error estándar positivo y un error estándar negativo.

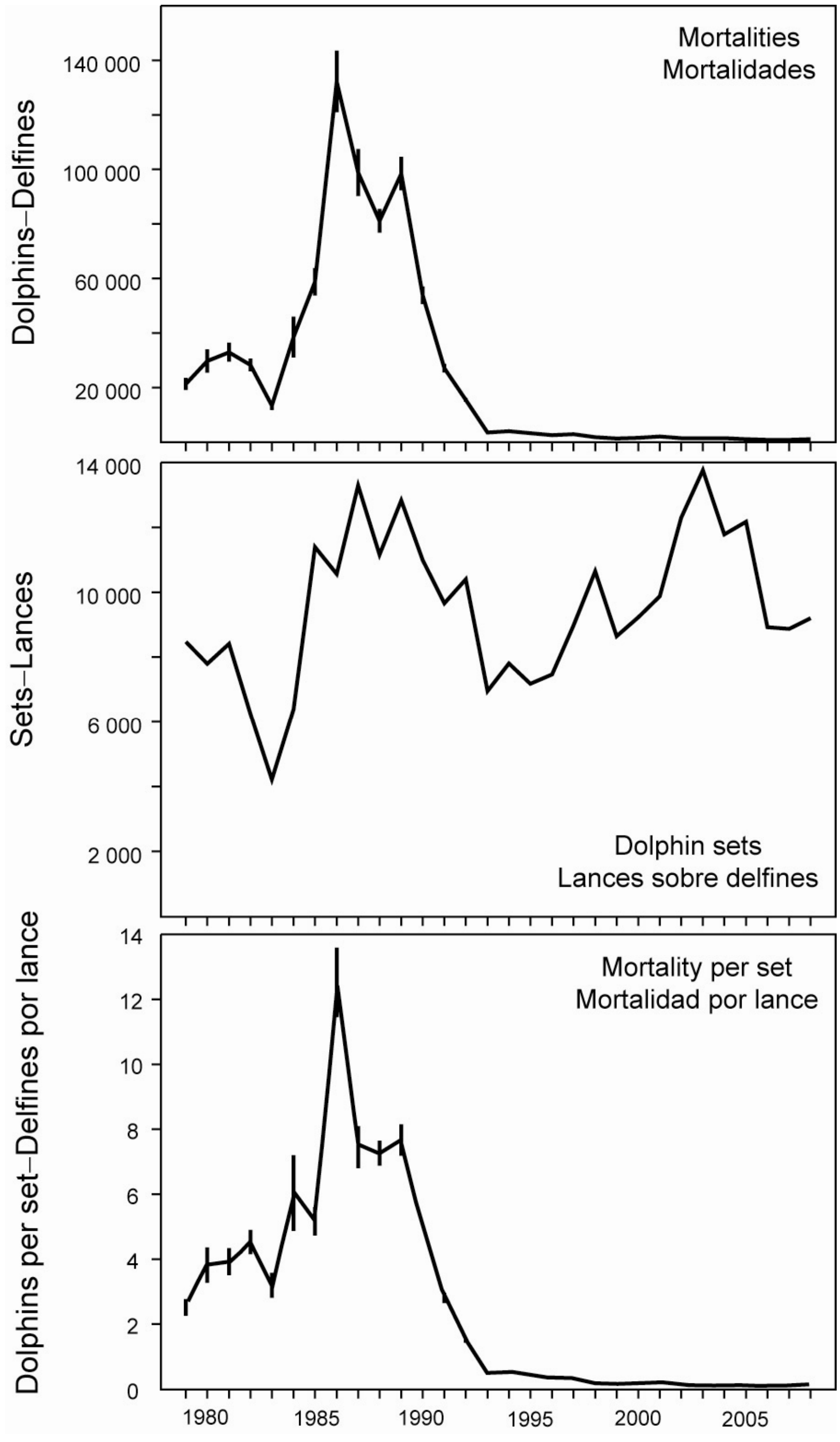

FIGURE 6. Total number of dolphin sets and average mortality per set (upper panel) and estimated total mortality (lower panel) for all dolphins in the EPO, 1979-2007. Each vertical line represents one positive and one negative standard error.

FIGURA 6. Número total de lances sobre delfines y mortalidad media por lance (panel superior) y mortalidad total estimada (panel inferior) para todas especies de delfines en el OPO, 1979-2007. Cada línea vertical representa un error estándar positivo y un error estándar negativo.

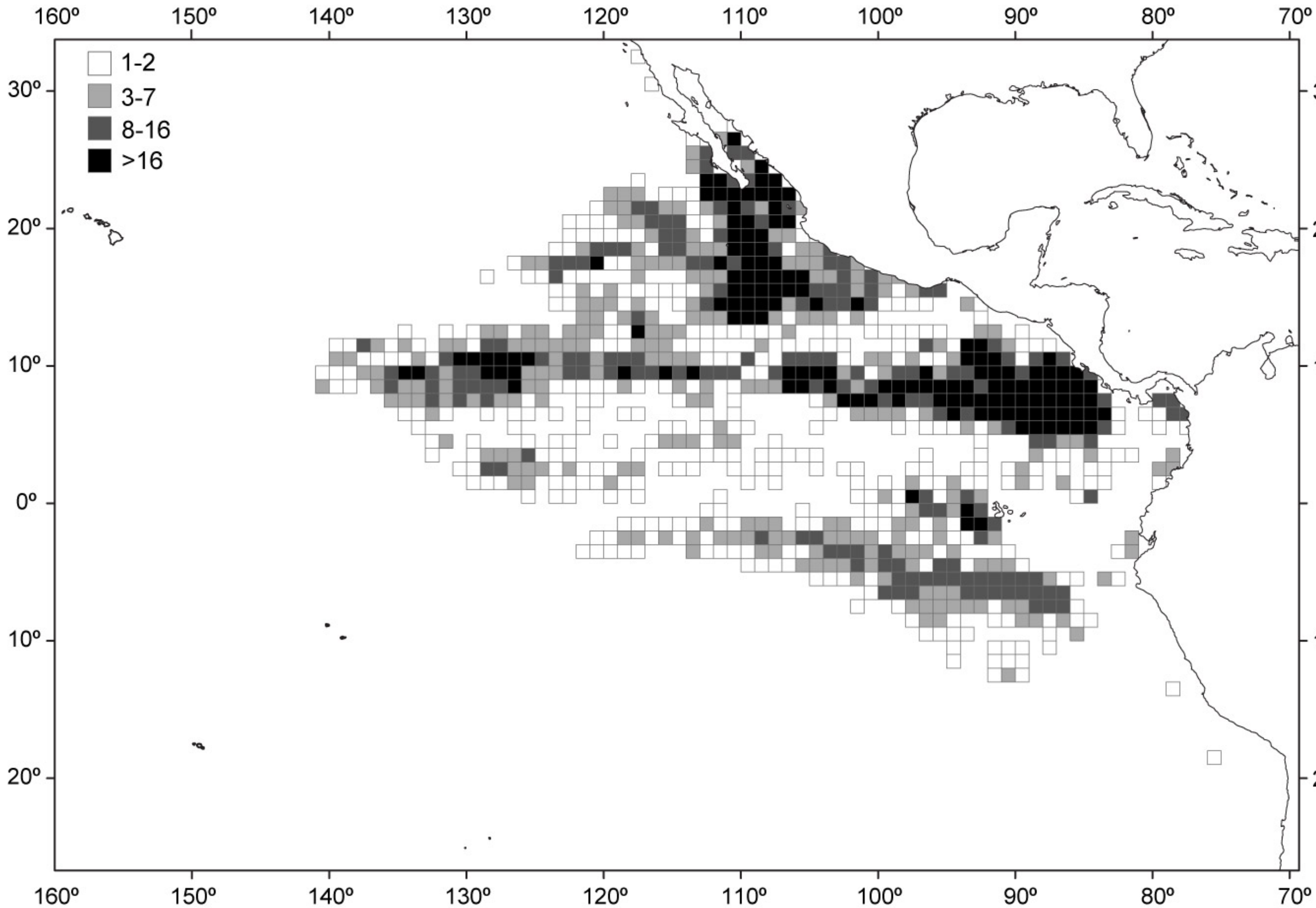

FIGURE 7. Spatial distribution of sets on tuna associated with dolphins, 2008, obtained from combined data for the IATTC and national observer programs.
FIGURA 7. Distribución espacial de los lances sobre atunes asociados con delfines, 2008, obtenida de datos combinados de los programas de observadores de la CIAT y nacionales.

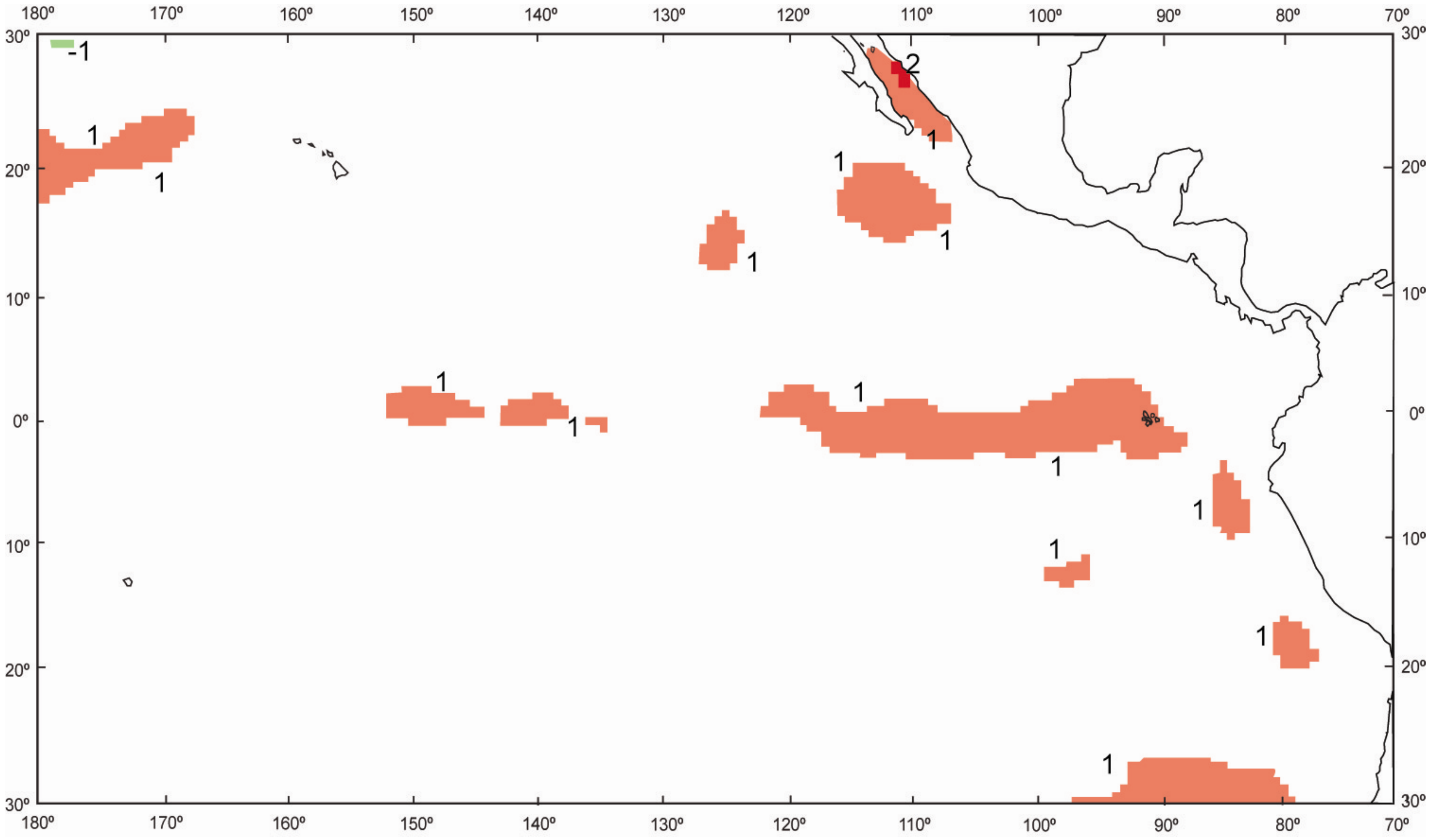

FIGURE 8. Sea-surface temperature (SST) anomalies (departures from long-term normals) for June 2009, based on data from fishing boats and other types of commercial vessels.
FIGURA 8. Anomalías (variaciones de los niveles normales a largo plazo) de la temperatura superficial del mar (TSM) en junio de 2009, basadas en datos tomados por barcos pesqueros y otros buques comerciales.

TABLE 1. Preliminary estimates of the numbers and capacities, in cubic meters, of purse seiners and pole-and-line vessels operating in the EPO in 2009 by flag, gear, and well volume. Each vessel is included in the totals for each flag under which it fished during the year, but is included only once in the fleet total. Therefore the totals for the fleet may not equal the sums of the individual flag entries. PS = purse seine; LP = pole-and-line.

TABLA 1. Estimaciones preliminares del número de buques cerqueros y cañeros que pescan en el OPO en 2009, y de la capacidad de acarreo de los mismos, en metros cúbicos, por bandera, arte de pesca, y volumen de bodega. Se incluye cada buque en los totales de cada bandera bajo la cual pescó durante el año, pero solamente una vez en el total de la flota; por consiguiente, los totales de las flotas no son siempre iguales a las sumas de las banderas individuales. PS = cerquero; LP = cañero.

Flag	Gear	Well volume–Volumen de bodega				Capacity
Bandera	Arte	1-900	901-1700	>1700	Total	Capacidad
			Number—Número			
Bolivia	PS	1	-	-	1	222
Colombia	PS	4	10	-	14	14,860
Ecuador	PS	62	14	9	85	60,781
España—Spain	PS	-	-	4	4	10,116
Guatemala	PS	-	1	1	2	3,575
Honduras	PS	1	1	-	2	1,559
México	PS	16	32	1	49	51,968
	LP	4	-	-	4	380
Nicaragua	PS	-	5	-	5	6,353
Panamá	PS	5	17	3	25	31,811
Perú	PS	2	-	-	2	1,000
El Salvador	PS	-	1	3	4	7,415
USA—EE.UU.	PS	-	1	2	3	5,315
Venezuela	PS	-	20	2	22	30,629
Vanuatu	PS	1	2	-	3	3,609
All flags—	PS	92	104	25	221	
Todas banderas	LP	4	-	-	4	
	PS + LP	96	104	25	225	
			Capacity—Capacidad			
All flags—	PS	41,556	133,661	53,996	229,213	
Todas banderas	LP	380	-	-	380	
	PS + LP	41,936	133,661	53,996	229,593	

TABLE 2. Changes in the IATTC fleet list recorded during the second quarter of 2009. PS = purse seine; LP = pole-and-line.
TABLA 2. Cambios en la flota observada por la CIAT registrados durante el segundo trimestre de 2009. PS = cerquero; LP = cañero.

Vessel name	Flag	Gear	Capacity (m^3)	Remarks
Nombre del buque	**Bandera**	**Arte**	**Capacidad (m^3)**	**Comentarios**
Vessels added to the fleet—Buques añadidos a la flota				
New entry—1er ingreso				
				Now—Ahora
Cap Tino B.	Ecuador	PS	328	
White Dove Too	Panamá	PS	465	Ecuador
Re-entries—Reingresos				
				Now—Ahora
Tunamar	Panamá	PS	1,402	
Caribe Tuna	Venezuela	PS	1,260	
Vessels removed from fleet—Buques retirados de la flota				
Tiuna	Panamá	PS	1,202	
Jeannine	Unknown—Desconocido	PS	1,281	

TABLE 3. Preliminary estimates of the retained catches of tunas in the EPO from 1 January through 28 June 2009, by species and vessel flag, in metric tons.
TABLA 3. Estimaciones preliminares de las capturas retenidas de atunes en el OPO del 1 de enero al 28 de junio 2009, por especie y bandera del buque, en toneladas métricas**.**

Flag	Yellowfin	Skipjack	Bigeye	Pacific bluefin	Bonitos (*Sarda* spp.)	Albacore	Black skipjack	Other[1]	Total	Percentage of total
Bandera	**Aleta amarilla**	**Barrilete**	**Patudo**	**Aleta azul del Pacífico**	**Bonitos (*Sarda* spp.)**	**Albacora**	**Barrilete negro**	**Otras[1]**	**Total**	**Porcentaje del total**
Ecuador	8,583	66,467	16,084	-	-	-	18	66	91,218	31.7
México	60,797	4,763	926	619	6	2	3,108	-	70,221	24.4
Nicaragua	3,296	2,612	535	-	-	-	-	-	6,443	2.2
Panamá	18,770	15,131	3,929	-	-	-	-	82	37,912	13.2
Venezuela	15,906	12,126	1,165	-	-	-	-	1	29,198	10.2
Other—Otros[2]	22,956	24,140	5,425	-	-	-	-	-	52,521	18.3
Total	130,308	125,239	28,064	619	6	2	3,126	149	287,513	

[1] Includes other tunas, sharks, and miscellaneous fishes
[1] Incluye otros túnidos, tiburones, y peces diversos
[2] Includes Bolivia, Colombia, El Salvador, Guatemala, Honduras, Peru, Spain, United States, and Vanuatu; this category is used to avoid revealing the operations of individual vessels or companies.
[2] Incluye Bolivia, Colombia, El Salvador, España, Estados Unidos, Guatemala, Honduras, Perú, y Vanuatú; se usa esta categoría para no revelar información sobre faenas de buques o empresas individuales.

TABLE 4. Logged catches and catches per day's fishing[1] (CPDF) of yellowfin in the EPO, in metric tons, during the period of 1 January-31 March, based on fishing vessel logbook information. Because the catches in this table include only data that meet the requirements for calculation of the CPDFs, they are less than the total catches for the first quarters of 2004-2009.

TABLA 4. Captura registrada y captura por día de pesca[1] (CPDP) de aleta amarilla en el OPO, en toneladas métricas, durante el período de 1 de enero-31 de marzo, basado en información de los cuadernos de bitácora de buques pesqueros. Ya que las capturas en esta tabla incluyen solamente los datos que satisfacen los requisitos para el cálculo de la CPDP, son menos que las capturas totales del primer trimestre durante 2004-2009.

Area	**Fishery statistic**	**Year-Año**					
	Estadística de pesca	**2004**	**2005**	**2006**	**2007**	**2008**	**2009[2]**
Purse seine—Red de cerco							
North of 5°N	Catch—Captura	31,900	39,700	24,900	26,300	23,600	21,800
Al norte de 5°N	CPDF—CPDP	11.8	13.7	9.0	9.2	10.2	17.7
South of 5°N	Catch—Captura	42,400	24,200	11,200	9,700	11,200	6,200
Al sur de 5°N	CPDF—CPDP	9.0	6.9	2.8	3.2	3.3	2.5
Total	Catch—Captura	74,300	63,900	36,100	36,000	34,800	28,000
	CPDF—CPDP	10.2	11.1	7.1	7.6	7.9	14.3
Annual total Total anual	Catch—Captura	193,200	162,000	106,400	107,700	116,000	
Pole and line—Cañero							
Total	Catch—Captura	<100	200				<100
	CPDF—CPDP	1.8	3.8				1.6
Annual total Total anual	Catch—Captura	1,800	800	500	800	500	

[1] Purse-seiners with carrying capacities greater than 363 t only; all pole-and-line vessels. The catch values are rounded to the nearest 100, and the CPDF values to the nearest 0.1.

[1] Cerqueros con capacidad de acarreo más de 363 t únicamente; todos buques cañeros. Se redondean los valores de captura al 100 más cercano, y los de CPDP al 0.1 más cercano.

[2] Preliminary

[2] Preliminar

TABLE 5. Logged catches and catches per day's fishing[1] (CPDF) of skipjack in the EPO, in metric tons, during the period of 1 January-31 March, based on fishing vessel logbook information. Because the catches in this table include only data that meet the requirements for calculation of the CPDFs, they are less than the total catches for the first quarters of 2004-2009.

TABLA 5. Captura registrada y captura por día de pesca[1] (CPDP) de barrilete en el OPO, en toneladas métricas, durante el período de 1 de enero-31 de marzo, basado en información de los cuadernos de bitácora de buques pesqueros. Ya que las capturas en esta tabla incluyen solamente los datos que satisfacen los requisitos para el cálculo de la CPDP, son menos que las capturas totales del primer trimestre durante 2004-2009.

Area	**Fishery statistic Estadística de pesca**	**Year-Año 2004**	**2005**	**2006**	**2007**	**2008**	**2009[2]**
	Purse seine—Red de cerco						
North of 5°N	Catch—Captura	4,100	10,300	3,100	4,600	5,400	1,000
Al norte de 5°N	CPDF—CPDP	1.5	3.5	1.1	1.6	2.3	.8
South of 5°N	Catch—Captura	36,500	46,000	29,300	21,600	48,000	28,500
Al sur de 5°N	CPDF—CPDP	7.7	13.2	7.3	7.1	14.0	11.5
Total	Catch—Captura	40,600	56,300	32,400	26,200	53,400	29,500
	CPDF—CPDP	7.1	11.4	6.7	6.1	12.8	11.1
Annual total Total anual	Catch—Captura	132,500	148,600	146,800	86,400	139,400	
	Pole and line—Cañero						
Total	Catch—Captura	<100	<100				<100
	CPDF—CPDP	1.9	1.2				0.7
Annual total Total anual	Catch—Captura	500	400	300	200	200	

[1] Purse-seiners with carrying capacities greater than 363 t only; all pole-and-line vessels. The catch values are rounded to the nearest 100, and the CPDF values to the nearest 0.1.

[1] Cerqueros con capacidad de acarreo más de 363 t únicamente; todos buques cañeros. Se redondean los valores de captura al 100 más cercano, y los de CPDP al 0.1 más cercano.

[2] Preliminary

[2] Preliminar

TABLE 6. Logged catches and catches per day's fishing[1] (CPDF) of bigeye in the EPO, in metric tons, during the period of 1 January-31 March, based on purse-seine vessel logbook information. Because the catches in this table include only data that meet the requirements for calculation of the CPDFs, they are less than the total catches for the first quarters of 2004-2009.

TABLA 6. Captura registrada y captura por día de pesca[1] (CPDP) de patudo en el OPO, en toneladas métricas, durante el período de 1 de enero-31 de marzo, basado en información de los cuadernos de bitácora de buques cerqueros. Ya que las capturas en esta tabla incluyen solamente los datos que satisfacen los requisitos para el cálculo de la CPDP, son menos que las capturas totales del primer trimestre durante 2004-2009.

Fishery statistic—Estadística de pesca	Year—Año					
	2004	2005	2006	2007	2008	2009[2]
Catch—Captura	7,200	6,100	8,200	4,300	9,400	4,000
CPDF—CPDP	1.4	1.4	1.8	1.3	2.7	1.3
Total annual catch—Captura total anual	43,100	28,500	34,100	23,900	31,800	

1 Vessels with carrying capacities greater than 363 t only. The catch values are rounded to the nearest 100, and the CPDF values to the nearest 0.1.

1 Buques con capacidad de acarreo más de 363 t únicamente. Se redondean los valores de captura al 100 más cercano, y los de CPDF al 0.1 más cercano.

2 Preliminary

2 Preliminar

TABLE 7. Catches of bigeye tuna in the eastern Pacific Ocean during 2009 by longline vessels.

TABLA 7. Captures de atún patudo en el Océano Pacífico oriental durante 2009 por buques palangreros.

	First quarter	Month 4	5	6	Second quarter	Total to date
	Primer trimestre	Mes 4	5	6	Segundo trimestre	Total al fecha
China	-	-	-	-	-	-
European Union—Unión Europea	-	-	-	-	-	-
Japan—Japón	3,362	862	753	1.198	2,813	6,175
Republic of Korea—República de Corea	-	-	-	-	-	-
Chinese Taipei—Taipei Chino	461	175	290	160	625	1,086
USA—EE.UU.	-	-	-	-	-	-
Vanuatu	-	-	-	-	-	-
Total	3.823	1,037	1,043	1,358	3,438	7,261

TABLE 8. Preliminary data on the sampling coverage of trips by vessels with capacities greater than 363 metric tons by the observer programs of the IATTC, Colombia, Ecuador, the European Union, Mexico, Nicaragua, Panama, and Venezuela during the second quarter of 2009. The numbers in parentheses indicate cumulative totals for the year.

TABLA 8. Datos preliminares de la cobertura de muestreo de viajes de buques con capacidad más que 363 toneladas métricas por los programas de observadores de la CIAT, Colombia, Ecuador, México, Nicaragua, Panamá, el Unión Europea, y Venezuela durante el segundo trimestre de 2009. Los números en paréntesis indican totales acumulados para el año.

Flag	Trips		Observed by program						Percent observed	
			IATTC		National		Total			
Bandera	Viajes		Observado por programa						Porcentaje observado	
			CIAT		Nacional		Total			
Colombia	9	(32)	6	(18)	3	(14)	9	(32)	100.0	(100.0)
Ecuador	64	(164)	45	(109)	19	(55)	64	(164)	100.0	(100.0)
España—Spain	7	(14)	4	(8)	3	(6)	7	(14)	100.0	(100.0)
Guatemala	2	(6)	2	(6)			2	(6)	100.0	(100.0)
Honduras	4	(8)	4	(8)			4	(8)	100.0	(100.0)
México	45	(113)	26	(60)	19	(53)	45	(113)	100.0	(100.0)
Nicaragua	4	(12)	1	(4)	3	(8)	4	(12)	100.0	(100.0)
Panamá	29	(65)	16	(34)	13	(31)	29	(65)	100.0	(100.0)
Perú	1	(3)	1	(3)			1	(3)	100.0	(100.0)
El Salvador	6	(16)	6	(16)			6	(16)	100.0	(100.0)
U.S.A.—EE.UU.	3	(6)	3	(5)		(1)[1]	3	(6)	100.0	(100.0)
Venezuela	21	(46)	10	(21)	11	(25)	21	(46)	100.0	(100.0)
Vanuatu	4	(8)	4	(8)			4	(8)	100.0	(100.0)
Total	199	(493)[2]	128	(300)	71	(193)	199	(493)[2]	100.0	(100.0)

[1] One trip by a U.S.-flag vessel was sampled by the national observer program of Panama (PRONAOP). The vessel was Panamanian flag until just prior to its departure, and a national observer had already been assigned to the vessel.

[1] Un viaje por un buque de pabellón de EE.UU. fue muestreado por el programa nacional de observadores de Panamá (PRONAOP). El buque fue de pabellón de Panamá hasta justo antes de zarpar, y ya le había sido asignado un observador nacional.

[2] Includes 65 trips (40 by vessels with observers from the IATTC program and 25 by vessels with observers from the national programs) that began in late 2008 and ended in 2009

[2] Incluye 65 viajes (40 por observadores del programa del CIAT y 25 por observadores de los programas nacionales) iniciados a fines de 2008 y completados en 2009

TABLE 9. Estimates of mortalities of dolphins in 2008, population abundance, and relative mortality, by stock.
TABLA 9. Estimaciones de la mortalidad incidental de delfines en 2008, la abundancia de poblaciones, y la mortalidad relativa, por población.

Species and stock	Incidental mortality	Population abundance	Relative mortality (percent)
Especie y población	**Mortalidad incidental**	**Abundancia de la población**	**Mortalidad relativa (porcentaje)**
Offshore spotted dolphin—Delfín manchado de altamar[1]			
Northeastern—Nororiental	179	782,900	0.02
Western-southern—Occidental y sureño	165	892,600	0.02
Spinner dolphin—Delfín tornillo[1]			
Eastern—Oriental	349	592,200	0.06
Whitebelly—Panza blanca	170	617,100	0.03
Common dolphin—Delfín común[2]			
Northern—Norteño	107	449,462	0.02
Central	14	577,048	<0.01
Southern—Sureño	138	1,525,207	<0.01
Other dolphins—Otros delfines[3]	49	2,802,300	<0.01
Total	1,171		

[1] logistic model for 1986-2003 (updated calculation based on IATTC Special Report 14: Appendix 7)
[1] modelo logístico para 1986-2003 (cálculo actualizado basado en el Informe Especial de la CIAT 14: Anexo 7)
[2] weighted averages for 1998-2003 (IATTC Special Report 14: Appendix 5)
[2] promedios ponderados para 1998-2003 (Informe Especial de la CIAT 14: Anexo 5)
[3] Pooled for 1986-1990 (Report of the International Whaling Commission, 43: 477-493)
[3] Agrupados para 1986-1990 (Informe de la Comisión Ballenera Internacional, 43: 477-493)
[4] "Other dolphins" includes the following species and stocks, whose observed mortalities were as follows: Other dolphins" includes the following species and stocks, whose observed mortalities were as follows: striped dolphins (*Stenella coeruleoalba*), 24; coastal spotted dolphin (*Stenella attenuata*), 4; Central American spinner dolphin (*Stenella longirostris centroamericana*) 9; bottlenose dolphin (*Tursiops truncatus*) 4; and unidentified dolphins, 8.
[4] "Otros delfines" incluye las siguientes especies y poblaciones, con las mortalidades observadas correspondientes: delfín listado (*Stenella coeruleoalba*), 24; delfin manchado costero (*Stenella attenuata*), 4; delfin tornillo centroamericano (*Stenella longirostris centroamericana*) 9; tonina (*Tursiops truncatus*) 4; y delfines no identificados, 8.
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TABLE 10. Annual estimates of dolphin mortality, by species and stock, 1979-2008. The data for 2008 are preliminary. The sums of the estimated mortalities for the northeastern and western-southern stocks of offshore spotted dolphins do not necessarily equal those for the previous stocks of northern and southern offshore spotted dolphins because the estimates for the two stock groups are based on different areal strata, and the mortalities per set and the total numbers of sets vary spatially.
TABLA 10. Estimaciones anuales de la mortalidad de delfines, por especie y población, 1979-2008. Los dataos de 2008 son preliminares. Las sumas de las mortalidades estimadas para las poblaciones nororiental y occidental y sureño del delfín manchado de altamar no equivalen necesariamente a las sumas de aquéllas para las antiguas poblaciones de delfín manchado de altamar norteño y sureño porque las estimaciones para los dos grupos de poblaciones se basan en estratos espaciales diferentes, y las mortalidades por lance y el número total de lances varían espacialmente.

Year	Offshore spotted[1]		Spinner		Common			Others	Total
	North-eastern	Western-southern	Eastern	White belly	Northern	Central	Southern		
Año	Manchado de altamar[1]		Tornillo		Común			Otros	Total
	Nor-oriental	Occidental y sureño	Oriental	Panza blanca	Norteño	Central	Sureño		
1979	4,828	6,254	1,460	1,312	4,161	2,342	94	880	21,331
1980	6,468	11,200	1,108	8,132	1,060	963	188	633	29,752
1981	8,096	12,512	2,261	6,412	2,629	372	348	367	32,997
1982	9,254	9,869	2,606	3,716	989	487	28	1,347	28,296
1983	2,430	4,587	745	4,337	845	191	0	353	13,488
1984	7,836	10,018	6,033	7,132	0	7,403	6	156	38,584
1985	25,975	8,089	8,853	6,979	0	6,839	304	1,777	58,816
1986	52,035	20,074	19,526	11,042	13,289	10,884	134	5,185	132,169
1987	35,366	19,298	10,358	6,026	8,216	9,659	6,759	3,200	98,882
1988	26,625	13,916	18,793	3,545	4,829	7,128	4,219	2,074	81,129
1989	28,898	28,530	15,245	8,302	1,066	12,711	576	3,123	98,451
1990	22,616	12,578	5,378	6,952	704	4,053	272	1,321	53,874
1991	9,005	4,821	5,879	2,974	161	3,182	115	990	27,127
1992	4,657	1,874	2,794	2,044	1,773	1,815	64	518	15,539
1993	1,139	757	821	412	81	230	0	161	3,601
1994	935	1,226	743	619	101	151	0	321	4,096
1995	952	859	654	445	9	192	0	163	3,274
1996	818	545	450	447	77	51	30	129	2,547
1997	721	1,044	391	498	9	114	58	170	3,005
1998	298	341	422	249	261	172	33	100	1,876
1999	358	253	363	192	85	34	1	62	1,348
2000	295	435	275	262	54	223	10	82	1,636
2001	592	315	470	374	94	205	46	44	2,140
2002	435	203	403	182	69	155	3	49	1,499
2003	288	335	290	170	133	140	97	39	1,492
2004	261	256	223	214	156	97	225	37	1,469
2005	273	100	275	108	114	57	154	70	1,151
2006	147	135	160	144	129	86	40	45	886
2007	189	116	175	113	55	69	95	26	838
2008	183	165	349	170	107	14	138	45	1,171

[1] The estimates for offshore spotted dolphins include mortalities of coastal spotted dolphins.
[1] Las estimaciones de delfines manchados de altamar incluyen mortalidades de delfines manchados costeros.

TABLE 11. Standard errors of annual estimates of dolphin species and stock mortality for 1979-1994, and 2001-2003. There are no standard errors for 1995-2000, and 2004-2008, because the coverage was at or nearly at 100 percent during those years.
TABLA 11. Errores estándar de las estimaciones anuales de la mortalidad de delfines por especie y población para 1979-1994, y 2001-2003. No hay errores estándar para 1995-2000, y 2004-2008, porque la cobertura fue de 100%, o casi, en esos años.

Year	Offshore spotted		Spinner		Common			Other
	North-eastern	Western-southern	Eastern	Whitebelly	Northern	Central	Southern	
Año	**Manchado de altamar**		**Tornillo**		**Común**			**Otros**
	Nor-oriental	**Occidental y sureño**	**Oriental**	**Panza blanca**	**Norteño**	**Central**	**Sureño**	
1979	817	1,229	276	255	1,432	560	115	204
1980	962	2,430	187	3,239	438	567	140	217
1981	1,508	2,629	616	1,477	645	167	230	76
1982	1,529	1,146	692	831	495	168	16	512
1983	659	928	284	1,043	349	87	-	171
1984	1,493	2,614	2,421	3,773	-	5,093	3	72
1985	3,210	951	1,362	1,882	-	2,776	247	570
1986	8,134	2,187	3,404	2,454	5,107	3,062	111	1,722
1987	4,272	2,899	1,199	1,589	4,954	2,507	3,323	1,140
1988	2,744	1,741	1,749	668	1,020	1,224	1,354	399
1989	3,108	2,675	1,674	883	325	4,168	295	430
1990	2,575	1,015	949	640	192	1,223	95	405
1991	956	454	771	598	57	442	30	182
1992	321	288	168	297	329	157	8	95
1993	89	52	98	33	27	-	-	29
1994	69	55	84	41	35	8	-	20
2001	3	28	1	6	7	7	-	1
2002	1	2	1	1	1	1	1	1
2003	1	1	1	1	-	1	1	-

TABLE 12. Percentages of sets on dolphin-associated schools with no dolphin mortalities, with major gear malfunctions, with net collapses, with net canopies, average times of backdown (in minutes), and average number of live dolphins left in the net at the end of backdown.
TABLA 12. Porcentajes de lances sobre delfines sin mortalidad de delfines, con averías mayores, con colapso de la red, con abultamiento de la red, duración media del retroceso (en minutos), y número medio de delfines en la red después del retroceso.

Year	Sets with zero mortality (percent)	Sets with major malfunctions (percent)	Sets with net collapse (percent)	Sets with net canopy (percent)	Average duration of backdown (minutes)	Average number of live dolphins left in net after backdown
Año	**Lances sin mortalidad (porcentaje)**	**Lances con averías mayores (porcentaje)**	**Lances con colapso de la red (porcentaje)**	**Lances con abultamiento de la red (porcentaje)**	**Duración media del retroceso (minutos)**	**Número medio de delfines en la red después del retroceso**
1986	38.1	9.5	29.0	22.2	15.3	6.0
1987	46.1	10.9	32.9	18.9	14.6	4.4
1988	45.1	11.6	31.6	22.7	14.3	5.5
1989	44.9	10.3	29.7	18.3	15.1	5.0
1990	54.2	9.8	30.1	16.7	14.3	2.4
1991	61.9	10.6	25.2	13.2	14.2	1.6
1992	73.4	8.9	22.0	7.3	13.0	1.3
1993	84.3	9.4	12.9	5.7	13.2	0.7
1994	83.4	8.2	10.9	6.5	15.1	0.3
1995	85.0	7.7	10.3	6.0	14.0	0.4
1996	87.6	7.1	7.3	4.9	13.6	0.2
1997	87.7	6.6	6.1	4.6	14.3	0.2
1998	90.3	6.3	4.9	3.7	13.2	0.2
1999	91.0	6.6	5.9	4.6	14.0	0.1
2000	90.8	5.6	4.3	5.0	14.9	0.2
2001	91.6	6.5	3.9	4.6	15.6	0.1
2002	93.6	6.0	3.1	3.3	15.0	0.1
2003	93.9	5.2	3.5	3.7	14.5	<0.1
2004	93.8	5.4	3.4	3.4	15.2	<0.1
2005	94.9	5.0	2.6	2.7	14.5	<0.1
2006	93.9	5.7	3.3	3.5	15.8	<0.1
2007	94.2	5.1	1.6	3.4	15.2	<0.1
2008	92.4	4.9	2.9	3.7	16.1	0.1

TABLE 13. Oceanographic and meteorological data for the Pacific Ocean, July 2008-June 2009. The values in parentheses are anomalies. SST = sea-surface temperature; SOI = Southern Oscillation Index; SOI* and NOI* are defined in the text.
TABLA 13. Datos oceanográficos y meteorológicos del Océano Pacífico, julio 2008-junio 2009. Los valores en paréntesis son anomalías. TSM = temperatura superficie del mar; IOS = Índice de Oscilación del Sur; IOS* y ION* están definidas en el texto.

Month—Mes	**7**	**8**	**9**	**10**	**11**	**12**
SST—TSM (°C)						
Area 1 (0°-10°S, 80°-90°W)	22.7 (0.8)	21.9 (1.1)	21.2 (0.7)	20.8 (-0.2)	21.5 (-0.2)	22.4 (-0.4)
Area 2 (5°N-5°S, 90°-150°W	26.1 (0.6)	25.7 (0.7)	25.1 (0.3)	24.8 (-0.1)	24.8 (-0.2)	24.6 (-0.5)
Area 3 (5°N-5°S, 120°-170°W)	27.2 (0.1)	26.9 (0.2)	26.5 (-0.2)	26.3 (-0.3)	26.3 (-0.2)	25.7 (-0.7)
Area 4 (5°N-5°S, 150W°-160°E)	28.3 (-0.3)	28.2 (-0.3)	28.1 (-0.4)	28.3 (-0.1)	28.1 (-0.3)	27.7 (-0.6)
Thermocline depth—Profundidad de la termoclina, 0°, 80°W (m)	35	45	30	45	35	20
Thermocline depth—Profundidad de la termoclina, 0°, 110°W (m)	50	60	45	45	35	20
Thermocline depth—Profundidad de la termoclina, 0°, 150°W (m)	170	125	125	120	140	125
Thermocline depth—Profundidad de la termoclina, 0°, 180°W (m)	170	170	170	170	165	180
Sea level—Nivel del mar, Callao, Perú (cm)	119.3 (9.2)	106.0 (-1.6)	107.2 (1.2)	104.7 (-1.0)	101.8 (-5.1)	97.8 (-10.8)
SOI—IOS	0.2	0.8	1.5	1.3	1.5	1.5
SOI*—IOS*	-3.87	-0.75	0.72	4.73	2.60	3.97
NOI*—ION*	-1.58	-1.44	-0.10	2.20	2.52	4.22

Month—Mes	**1**	**2**	**3**	**4**	**5**	**6**
SST—TSM (°C)						
Area 1 (0°-10°S, 80°-90°W)	24.3 (-0.2)	26.0 (-0.1)	26.4 (-0.1)	26.0 (0.5)	24.9 (0.6)	23.7 (0.7)
Area 2 (5°N-5°S, 90°-150°W	25.0 (-0.6)	25.8 (-0.6)	26.4 (-0.6)	27.4 (0.0)	27.4 (0.4)	27.1 (0.7)
Area 3 (5°N-5°S, 120°-170°W)	25.9 (-1.0)	26.0 (-0.7)	26.7 (-0.5)	27.5 (-0.2)	28.0 (0.3)	28.1 (0.6)
Area 4 (5°N-5°S, 150W°-160°E)	27.4 (-0.7)	27.4 (-0.7)	27.8 (-0.3)	28.4 (0.0)	29.0 (0.3)	29.2 (0.6)
Thermocline depth—Profundidad de la termoclina, 0°, 80°W (m)	20	10	10	10	35	30
Thermocline depth—Profundidad de la termoclina, 0°, 110°W (m)	25	25	70	60	90	90
Thermocline depth—Profundidad de la termoclina, 0°, 150°W (m)	140	130	130	150	160	150
Thermocline depth—Profundidad de la termoclina, 0°, 180°W (m)	180	180	190	210	190	160
Sea level—Nivel del mar, Callao, Perú (cm)	107.7 (-3.8)	110.2 (-3.7)	113.7 (-1.0)	112.4 (-2.1)	121.7 (8.2)	120.9 (8.9)
SOI—IOS	1.2	0.8	-0.1	0.7	-0.4	-0.3
SOI*—IOS*	3.18	3.66	1.06	137	1.81	-5.62
NOI*—ION*	6.76	-1.16	4.57	3.12	1.11	-2.38