INTER-AMERICAN TROPICAL TUNA COMMMISSION
COMISION INTERAMERICANA DEL ATUN TROPICAL
QUARTERLY REPORT—INFORME TRIMESTRAL

April-June 2002
Abril-Junio 2002

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8604 La Jolla Shores Drive

La Jolla, California 92037-1508, USA

www.iattc.org

The

QUARTERLY REPORT

April-June 2002

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

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COMISION INTERAMERICANA DEL ATUN 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

SPECIAL ANNOUNCEMENT

We are pleased to report that Peru became the 13th member of the IATTC on June 27, 2002.

DATA COLLECTION

The IATTC has field offices at Las Playas and Manta, Ecuador; Ensenada and Mazatlan, Mexico; Panama, Republic of Panama; Mayaguez, Puerto Rico, USA; and Cumaná, Venezuela.

Personnel at these offices and in La Jolla collected 273 length-frequency samples and abstracted the logbook information for 230 trips of fishing vessels during the second quarter of 2002.

Also, during the second quarter members of the field office staffs placed IATTC observers on 129 fishing trips by vessels that participate in the AIDCP On-Board Observer Program (combined observer programs of the IATTC, Ecuador, Mexico, and Venezuela). In addition, 130 IATTC observers completed trips during the quarter, and were debriefed at the corresponding field offices.

Surface fleet and surface catch statistics

Statistical data 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 vessels that are fishing, or are expected to fish, in the eastern Pacific Ocean (east of 150°W; EPO) during 2002 is about 198,500 cubic meters (m^3) (Table 1). The weekly average at-sea capacity for the fleet, for the weekly periods ending April 8 through July 1, was about 119,200 m^3 (range: 106,400 to 132,100 m^3). The changes of flags and vessel names and additions to and deletions from the IATTC's fleet list for the period of April 2-July 1 are given in Table 2.

Catch and catch-per-unit-of-effort statistics

Catch statistics

The total retained catches of tunas in the EPO for the January 1-July 1, 2002, period were estimated to be about 222 thousand metric tons (mt) of yellowfin, 88 thousand mt of skipjack, and 17 thousand mt of bigeye. The averages and ranges for the comparable periods of 1997-2001 are as follows: yellowfin, 164 thousand mt (132 to 224 thousand); skipjack, 98 thousand mt

(52 to 152 thousand); bigeye, 25 thousand mt (15 to 41 thousand). For second quarter the average estimated weekly retained catches of yellowfin, skipjack, and bigeye in the EPO were about 8 thousand, 3 thousand, and 1 thousand mt, respectively. Summaries of the estimated retained catches, 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 and skipjack are made by Class-6 vessels (vessels with well volumes greater than 425 m^3), and only data for Class-6 purse seiners 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.

During the 1997-2001 report periods the catch per day's fishing (CPDF) of yellowfin by purse seiners in the EPO north of 5°N averaged about 17.2 mt (range about 14.2 to 23.1 mt), whereas south of 5°N it averaged about 17.5 mt (range about 4.2 to 17.5 mt). Preliminary estimates for 2002 show the CPDFs of yellowfin north and south of 5°N to have been about 34.6 and 6.8 mt, respectively.

In general, the greatest catches of skipjack in the EPO are taken in waters south of 5°N. During the 1997-2001 periods the CPDF of skipjack by purse seiners south of 5°N averaged about 11.4 mt (range: about 5.5 to 21.2 mt), whereas north of 5°N it averaged about 2.2 mt (range: about 0.8 to 5.1 mt). Preliminary estimates for 2002 show the CPDFs of skipjack south and north of 5°N to have been about 10.4 and 0.7 mt, respectively.

The CPDF of bigeye in the EPO by purse seiners during the 2002 report period is estimated to have been about 2.3 mt, which falls within the range of the rates observed during the 1997-2001 period (1.7 to 5.1 mt) (Table 6).

The CPDF of yellowfin in the EPO by pole-and-line vessels during the 2002 report period is estimated to have been about 1.2 mt, which falls within the range of the rates observed during the 1997-2001 report periods (0.9 to 4.6 mt) (Table 4). The CPDF of skipjack in the EPO by pole-and-line vessels during the 2002 report period is estimated to have been about 1.7 mt, which is above the range of the rates observed during the 1997-2001 report periods (0.1 to 0.8 mt) (Table 5).

Size compositions of the surface catches of tunas

The methods for sampling the catches of tunas are described in the IATTC Annual Report for 2000. Briefly, the fish in a well of a purse seiner 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 1997-2002 are presented in this report. Two length-frequency histograms are presented for each species. The first shows the data by fishery (area, gear type, and set type) for the first quarter of 2002. The second shows the first-quarter catches for the current year and the previous five years. There were 270 wells sampled during the first quarter of 2002.

There are ten surface fisheries for yellowfin defined for stock assessments: four floating-object, two unassociated school, three dolphin, and one pole-and-line (Figure 1). Of the 270 wells sampled, 257 contained yellowfin. The estimated size compositions of these fish are shown in Figure 2a. As was the case during the past two quarters, the majority of the yellowfin catch during the first quarter of 2002 was taken in dolphin sets in the North and Inshore areas. The average weight of yellowfin caught in the southern dolphin fishery, 46.3 kg, was more than twice that of any of the other fisheries. Small amounts of yellowfin, most of which were small fish, were taken in floating-object sets and by pole-and-line vessels, but the estimated catches do not show well in the graph.

The estimated size compositions of the yellowfin caught by all fisheries combined during the first quarter of 1997-2002 are shown in Figure 2b. The size ranges of the fish are generally consistent over time (40-160 cm), but the size distributions differ among quarters and among years. The conspicuous mode between 90 and 120 cm noted during the third and fourth quarters of 2001 is no longer distinct; however, three smaller modes appeared during the first quarter of 2002, one between 40 and 55 cm, one between 60 and 100 cm, and one between 110 and 150 cm.

There are eight fisheries for skipjack defined for stock assessments: four floating-object, two unassociated school, one dolphin, and one pole-and-line (Figure 1). The last two fisheries include all 13 sampling areas. Of the 270 wells sampled, 127 contained skipjack. The estimated size compositions of these fish are shown in Figure 3a. Most of the skipjack were caught in the south, especially in the floating object fishery. The two distinct modes present during the previous quarter, one between 35 and 50 cm and the other between 55 and 70 cm, appeared in all of the floating-object fisheries and in the southern unassociated fishery during the first quarter, although the distributions in the North and Galapagos areas are difficult to see in the graph. Negligible amounts of skipjack were taken in dolphin sets, in the northern unassociated fishery, and by pole-and-line vessels.

The estimated size compositions of the skipjack caught by all fisheries combined during the first quarter of 1997-2002 are shown in Figure 3b. As was the case during the previous quarter, the two modes mentioned above are evident in the combined histogram of all fisheries; however, the fish caught were smaller than during the first quarter of 2002.

There are seven surface fisheries for bigeye defined for stock assessments: four floating-object, one unassociated school, one dolphin, and one pole-and-line (Figure 1). The last three fisheries include all 13 sampling areas. Of the 270 wells sampled, 44 contained bigeye. The estimated size compositions of these fish are shown in Figure 4a. During the first quarter of 2002, most of the bigeye were caught in the southern floating-object fishery. There were two distinct modes apparent in this fishery, one between 40 and 55 cm and the other between 125 and 150 cm. The smaller fish were not a large component of the catch in the floating-object fishery in the Galapagos area, where the average weight of the fish was nearly double that of the southern floating-object fishery. A small amount of bigeye was caught in sets on unassociated schools and in the Inshore floating-object fishery. There were no recorded catches of bigeye in dolphin sets or by pole-and-line vessels.

The estimated size compositions of the bigeye caught by all fisheries combined during the first quarter of 1997-2002 are shown in Figure 4b. The average weight of bigeye caught during the first quarter of 2002 was considerably less than that during the first quarter of 2001. This was due chiefly to the greater catches of fish between 40 and 50 cm in length during the first quarter of 2002.

The estimated retained catch of bigeye less than 60 cm in length during the first quarter of 2002 was 1,795 metric tons (mt). The corresponding amounts for 1997-2001 ranged from 515 to 3,985 mt.

Observer program

Coverage

The design for placement of observers during 2002 calls for 100-percent coverage of fishing trips in the eastern Pacific Ocean (EPO) by purse seiners with carrying capacities of more than 363 mt. Mexico's national observer program, the Programa Nacional de Aprovechamiento del Atún y de Protección de Delfines (PNAAPD), and Venezuela's national observer program, the Programa Nacional de Observadores de Venezuela (PNOV), are to sample half of the trips by vessels of their respective fleets, while IATTC observers are to sample the other half of those trips. Ecuador's national observer program, the Programa Nacional de Observadores Pesqueros de Ecuador (PROBECUADOR) began the year sampling approximately one-third of the trips by vessels of its fleet, and IATTC observers are to sample the remainder of those trips. The IATTC is to sample all trips of purse seiners with carrying capacities of more than 363 mt registered in other nations that fish for tunas in the EPO.

IATTC, PNAAPD, PNOV, and PROBECUADOR observers departed on 194 fishing trips aboard purse seiners with carrying capacities of more than 363 mt during the second quarter of 2002. Preliminary coverage data for these vessels during the quarter are shown in Table 7.

Training

There were no IATTC observer training courses held during the second quarter of 2002.

RESEARCH

Tuna tagging

Bigeye tuna tagging

A bigeye tuna tagging project was initiated with a cruise conducted in the equatorial eastern Pacific Ocean (EPO) during March to May 2000. Some results of this cruise are provided in the IATTC Annual Report for 2000. Another tagging cruise was conducted in the same general area from March 1 to May 24, 2002, on the chartered pole-and-line vessel *Her Grace.* The primary objective of this cruise was to tag and release, using conventional plastic dart tags, large numbers of small bigeye (<100 cm) in the area of the EPO where purse-seine vessels catch bigeye associated with fish-aggregating devices (FADs). The secondary objective was to implant functional archival tags in small bigeye and skipjack and dummy archival tags in skipjack.

Significant numbers of small bigeye tuna, found in association with whale sharks and TAO buoys between about 0° and 2°S at about 95°W, were tagged and released. (TAO stands for Tropical Atmosphere Ocean Project, which is sponsored by the United States, Japan, and France. There are about 70 TAO buoys moored between about 10°N and 10°S in the eastern, central, and western Pacific Ocean. These buoys gather oceanographic and meteorological data and relay them to shore via the Argos satellite system.) The numbers of releases and returns of tunas, as of the end of June, were as follows:

Species	Tag type	Released	Returned	Percent returned
Bigeye	Conventional	1,418	7	0.5
Bigeye	Archival	26	2	7.7
Skipjack	Conventional	257	0	0.0
Skipjack	Archival	36	0	0.0
Yellowfin	Conventional	195	1	0.5

The length frequencies of the fish tagged are shown in Figure 5.

In addition, an investigation of the behavior of bigeye and skipjack tuna around floating objects was initiated. This investigation was carried out during a 48-hour period within a large aggregation of tunas (>100 tons) and other large pelagic species associated with a TAO buoy, using sonic tags, sonar, an echo sounder, and underwater observations. This study will probably be continued.

Studies of yellowfin tuna with archival tags held in captivity

During January 2002 archival tags were implanted into the body cavities of 12 yellowfin, and these fish were placed into Tank 2 at the Achotines Laboratory. The experiment is being conducted to investigate whether feeding and/or spawning events can be detected by evaluating data on the temperatures of the peritoneal cavities of the fish recorded by the archival tags. During the second quarter five of the fish died due to secondary infections or starvation. At the end of the quarter the remaining seven fish were feeding well. Courtship behavior was observed in the tank on several dates in late April and early May, but no spawning occurred.

Early life history studies

Yellowfin broodstock

The yellowfin broodstock in Tank 1 (1,362,000 L) at the Achotines Laboratory spawned daily during April through June. Spawning occurred as early as 1:30 a.m. and as late as 11:30 a.m. The water temperatures in the tank ranged from 25.2° to 29.1°C during the quarter. The numbers of eggs collected after each spawning event ranged from about 57,000 to 3,800,000.

During the quarter one 24-kg fish died after striking the tank wall. At the end of June there were four size groups of fish in Tank 1: one 71-kg fish, five 48- to 53-kg fish, eight 17- to 22-kg fish, and two 10- to 11-kg fish.

Rearing of yellowfin eggs, larvae, and juveniles

During the quarter the following parameters were recorded for each spawning event: time 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.

Experiments with yellowfin larvae, juveniles, and cultured food organisms

During the fourth quarter of 2001 studies were conducted to compare the effects of antibiotics and probiotics (beneficial bacteria) on rotifer cultures and on the survival of yellowfin larvae. A detailed description of this work was given in the IATTC Quarterly Report for October-December 2001. The results of those experiments were inconclusive, so similar trials were conducted again during the first and second quarters of 2002. A preliminary analysis of the latest experiments indicated that probiotic treatments may have enhanced rotifer production, but that neither antibiotics nor probiotics significantly increased the survival of yellowfin larvae.

During the quarter two experiments were conducted with yellowfin larvae. The first experiment, which lasted 12 days, was designed to determine whether older larvae (>6.5 mm standard length (SL)) actively select larval fish prey when feeding in mixed-prey assemblages. The larvae were reared to a mean length of about 6.5 mm SL, using cultured food items, and then exposed to mixed-prey assemblages containing wild plankton (mostly copepods) and newly-hatched yellowfin larvae. Samples of larvae were removed from each tank daily and fixed in formalin for gut-content analysis. Concurrently, whole-water aliquots (500 mL) were taken randomly from each tank to measure the relative abundance of each prey type for calculation of indices of prey selectivity. Analysis of the food selection of the larvae will be completed during the third quarter of 2002.

The second experiment was conducted to evaluate the effect of light intensity on the feeding success and survival of yellowfin larvae. The larvae were exposed to three light intensities (two replicate tanks at each intensity) over a 10-day period. The light intensities used included the level routinely used in yellowfin rearing at the Laboratory (high), a level reduced by approximately 70 percent (medium), and a level reduced approximately 95 percent (low). Samples of larvae were removed from each tank daily and fixed in formalin for gut-content analysis. At the end of the 10-day period the survivors in each tank were counted. The survival was greatest for the high-intensity light, averaging 3 to 10 times those for the medium- and low-intensity light.

Several groups of yellowfin larvae were reared beyond juvenile metamorphosis. The longest time that a fish was reared during the quarter was 7 weeks after hatching.

Studies of the vision of yellowfin

In June 2001 a study was initiated to examine the spectral sensitivity of vision in several life stages of yellowfin tuna. The research, which was carried out by Drs. William McFarland, University of Washington, and Ellis Loew, Cornell University, working in collaboration with an IATTC scientist, is described in more detail in the IATTC Quarterly Report for April-June 2001.

Drs. McFarland and Loew returned to the Achotines Laboratory during the second quarter of 2002 to continue their studies. They conducted analyses of the spectral characteristics of nearshore, mixed-layer oceanic waters and the feeding environment in larval rearing tanks in the Laboratory. Spectral measurements were made with an underwater spectroradiometer, and the results will be analyzed as to the prevalent wave lengths of light in the waters examined. The goal of this analysis is to determine whether the spectral characteristics of natural mixed-layer waters and the water in the larval rearing tanks matches the spectral sensitivity of yellowfin larvae.

In addition, some preliminary feeding behavior and vision trials were conducted with yellowfin larvae and early-juveniles. The trials produced data on the feeding success of fish fed "greened" (containing phytoplankton) and "non-greened" (containing no phytoplankton) prey. The results will be analyzed during the third quarter.

Age and growth of yellowfin larvae

During the quarter growth rates and sizes-at-age were compared among yellowfin larvae collected in the coastal waters off the Azuero Peninsula near the Achotines Laboratory. Late-stage larvae (postflexion stage) were collected at night during the reduced-upwelling periods (June through September) of 1990, 1991, 1992, and 1997 with light traps and with dipnets with an underwater light. The larvae were aged by counting the daily increments in their otoliths, and their growth rates were estimated from the length-at-age data for all years except 1992.

Because field-collected yellowfin larvae cannot be differentiated from bigeye larvae by meristic and pigmentation patterns, mitochondrial DNA from tissue samples of the larvae was amplified by the polymerase chain reaction (PCR) technique, and restriction fragment-length polymorphism (RFLP) analysis was used to identify the species in the 1990 to 1992 collections. It was found that all of the fish were yellowfin. The analysis was performed by Dr. Naritoshi Chow of the National Research Institute of Far Seas Fisheries, Shimizu, Japan. PCR-RFLP analysis is also being used to determine the species of larvae collected in 1997.

The growth rates were significantly different in different years. The most rapid growth rate (1.27 mm d^{-1}), which occurred in June 1990, was significantly greater than those of July-August 1997 (0.71 mm d^{-1}) and August-September 1991 (0.59 mm d^{-1}). The average lengths and otolith diameters at age were also significantly less for the larvae collected during 1991 than for those collected during the other years. Sea-surface temperature anomalies and productivity levels were explored to attempt to explain some of the variation in growth among years.

It is believed that the yellowfin larvae are transported to the nearshore sampling area from offshore areas by the North Equatorial Countercurrent and surface winds that occur during June through September in the Panama Bight region. The maximum distances traveled and the areas that each year group of larvae inhabited were estimated from back-calculated spawning dates and average current and wind speeds. Sea-surface temperature anomalies and standardized zooplankton volumes from ichthyoplankton surveys (IATTC Annual Reports for 1989-1992) were examined within the area and time periods estimated for each year group.

The sea-surface temperatures were well above normal during 1997, when an El Niño event occurred, but nearly normal during 1990 and 1991. The zooplankton volumes, however, were significantly lower during 1991, when the slowest growth rate occurred. Therefore, the differences in growth rates among years may be more closely associated with food availability than with higher sea-surface temperatures. Density effects on growth (IATTC Quarterly Report for July-September 2001), especially during periods of seasonal patchiness of food organisms, may also be an important influence on larval growth and pre-recruitment survival of yellowfin tuna.

Studies of snappers and corvina

The work on snappers and corvina is carried out by the Dirección General de Recursos Marinos de Panamá.

The spotted rose snapper (*Lutjanus guttatus*) broodstock, which began to spawn at the end of May 2000, continued to spawn about two times per week during the second quarter. Another group of 40 fish, hatched in captivity in October 1998, was being held in two 12,000-L tanks. These 40 fish were being fed only three times per week in an attempt to eliminate fatty deposits in the abdominal cavity and permit natural maturation of the gonads. On average, these fish were about 48.6 cm long and weighed about 1.9 kg at the end of the quarter.

One group of 9 juvenile polla drum (*Umbrina xanti*), hatched in captivity in July 1999, was being held in a 12,000-L tank. The remaining fish were about 26 cm long and weighed about 175 g, on average, at the end of the quarter. These fish were to be used as broodstock.

Visitors at the Achotines Laboratory

Ms. Kerstin Sarter, an undergraduate student at the University of Heidelberg, who had worked as a volunteer student intern at the Achotines Laboratory for about 8 weeks, left the Laboratory to return to Germany on April 17, 2002.

Mr. Patrick Tracy, a graduate student at the University of Miami's Rosenstiel School of Marine and Atmospheric Science (RSMAS), who had been working intermittently at the Achotines Laboratory since October 2001, left the Laboratory to return to Miami on April 16, 2002. While at the Laboratory he carried out trials comparing the effects of antimicrobials and probiotics on the growth and survival of yellowfin eggs and larvae.

Dr. Daniel Benetti, Director of the Aquaculture Program at the RSMAS, spent the period of June 13-20, 2002, at the Achotines Laboratory. He was accompanied by four of his students in a graduate-level aquaculture management course. During their stay they worked with culture of algae, rotifers, copepods, and larval tuna.

Oceanography and meteorology

Easterly surface winds blow almost constantly over northern South America, which causes 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 eastern tropical Pacific (ETP). 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. Each of the four El Niño events during the 1969-1983 period was followed by better-than-average recruitment of yellowfin in the eastern Pacific Ocean two years later (Japan. Soc. Fish. Ocean., Bull., 53 (1): 77-80), and IATTC staff members are currently studying data for more recent years to see if this relationship has persisted and to see if it applies to skipjack and/or bigeye.

Two new indices, the SOI* and the NOI*, have recently been devised. These are described in the IATTC Quarterly Report for January-March 2001. The SOI* and NOI* values are both negative during El Niño events and positive during anti-El Niño events.

The SSTs were near normal during April and May 2002, but in June a narrow band of water more than 1°C above normal extending along the equator from about 105°W to 165°E appeared (Figure 6). In contrast, there were areas of water more than 1°C below normal off Ecuador and northern Peru and off Baja California. The data in Table 8, for the most part, indicate that conditions were near normal during most of the January-May period. In June, however, the SST anomalies, except at 0°-10°S, 80°-90°W, increased, and the sea levels at La Libertad, Ecuador, and Callao, Peru, fell, which is in keeping with Figure 6. According to the Climate Diagnostics Bulletin of the U.S. National Weather Service for June 2002, "Most statistical and coupled model predictions indicate that weak-to-moderate El Niño conditions will continue through the end of 2002 and into early 2003. It is important to add that a weak or moderate El Niño would feature much weaker global impacts than [those that] were experienced during the very strong" El Niño of 1997-1998.

GEAR PROGRAM

During the second quarter IATTC staff members participated in dolphin safety-gear inspection and safety-panel alignment procedures aboard nine Mexican-flag purse seiners.

The IATTC staff held a dolphin mortality reduction workshop in Panama City, Panama, on April 26, 2002. Twenty-two fishermen, three managers of fishing vessels, and one representative of the Panamanian government participated in the seminar. The Panamanian government provided logistical support in arranging the meeting.

MEETINGS

The background documents and the minutes or chairman's reports of most of the IATTC and AIDCP meetings described below are, or soon will be, available on the IATTC's web site, www.iattc.org.

Meetings of the IATTC and the AIDCP

The following meetings took place in La California, USA, in May 2002.

Meeting		Dates
	Meeting of the IATTC	
3	Scientific Working Group	May 6-8
	Meeting of the AIDCP	
	Scientific meeting on allocation of per stock, per year dolphin mortality caps	May 9

The following meetings took place in Manzanillo, Mexico, in June 2002.

Meeting		Dates
	Meetings of the IATTC	
3	Permanent Working Group on Compliance	June 25
69	IATTC	June 26-28
	Meetings of the AIDCP	
10	Permanent Working Group on Tuna Tracking	June 18
30	International Review Panel	June 19-20
7	Parties to the AIDCP	June 24
	Joint meeting of the IATTC and the AIDCP	
1	Working Group on Fishing by Non-Parties	June 21

Four resolutions were adopted at the 69th meeting of the IATTC**.** A resolution on conservation of yellowfin and bigeye tuna states that purse-seine vessels may not fish for tunas in the eastern Pacific Ocean during December 2002. A resolution on fleet capacity establishes the Regional Vessel Register as the list of purse seiners that are authorized to fish in the EPO and provides rules for making changes to the Register. A resolution on finance adopted a budget of $4,540,718 for the fiscal year of October 1, 2002-September 30, 2003, and provisional contributions of $4,550,854 for the fiscal year of October 1, 2003-September 30, 2004. These do not include assessments on vessels for the AIDCP On-Board Observer Program (combined observer programs of the IATTC, Ecuador, Mexico, and Venezuela).

Other meetings

Dr. Martín A. Hall attended the International Leatherback Turtle Survival Conference in Pacific Grove, California, USA, on April 22-25, 2002.

Dr. Robert J. Olson attended the Third International Conference on Applications of Stable Isotope Techniques in Ecological Studies in Flagstaff, Arizona, USA, on April 29-May 1, 2002.

Dr. Robin Allen and Ms. Nora Roa-Wade participated in a meeting of the International Fisheries Commissions Pension Society in Chicago, Illinois, USA, on April 29-May 2, 2002.

Dr. Michael G. Hinton participated in a workshop on standardizing longline effort in Honolulu, Hawaii, USA, on May 8-10, 2002.

Dr. Richard B. Deriso participated in a meeting of the Scientific and Statistical Committee of the Western Pacific Fishery Management Council of the United States in Honolulu, Hawaii, USA, on May 14-16, 2002.

Many staff members attended all or parts of the 53rd Tuna Conference at Lake Arrowhead, California, on May 20-23, 2002. Drs. Michael G. Hinton and Robert J. Olson and Mr. Shelton J. Harley served as moderators for sessions, and talks were given by Drs. Hinton, Olson, and Mark N. Maunder, Messrs. Harley, Edward H. Everett, and Vernon P. Scholey, and Mss. Jenny M Suter and Jeanne B. Wexler.

On May 23, 2002, Dr. Martín A. Hall attended a meeting in Guayaquil, Ecuador, organized by the Subsecretaria de Pesca of Ecuador, to discuss, with fishermen and others involved with the fishing industry, the feasibility of and interest in different options proposed to improve the selectivity of the fishery on floating objects. The meeting was conducted by Abog. R. Trujillo and Ing. L Torres, and the audience included representatives of the Instituto Nacional de Pesca, boat owners, fleet managers, fishing captains and other crew members, staff members of the IATTC field offices in Ecuador, and representatives of other organizations. Additional meetings with the same objective are planned for later in the year.

Dr. Robin Allen attended Tuna 2002, the Seventh INFOFISH World Tuna Trade Conference and Exhibition, in Kuala Lumpur, Malaysia, on May 30-June 1, 2002, where he presented a paper entitled Global Tuna Resources: Limits to Growth and Sustainability.

Dr. Mark N. Maunder and Mr. Shelton J. Harley attended the Census of Marine Life's Future of Marine Animal Populations' workshop on data, models, and prediction of marine biodiversity in Halifax, Nova Scotia, Canada, on June 20-23, 2002, where Dr. Maunder presented a paper entitled "Integrated Analysis."

Dr. Martín A. Hall participated in a technical workshop on sea turtles in Heredia, Costa Rica, on June 23-28, 2002. This workshop was part of the preparations for the first Conference of the Parties of the Inter-American Convention for the Protection and Conservation of Sea Turtles.

Mr. Kurt M. Schaefer participated in another Tagging of Pacific Pelagics (TOPP) workshop, which was held at the Hopkins Marine Station and the Monterey Bay Aquarium in Northern California on June 24-25, 2002. The workshop addressed various topics, including concepts and approaches to data acquisition and management and integration of data on oceanography and on the animals tagged.

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Allen, Robin. 2002. MHLC7—evaluation and comment. PFRP [Pelagic Fisheries Research Program, Joint Institute for Marine and Atmospheric Research, University of Hawaii at Manoa], 7 (2): 10-11.

Essington, Timothy E., Dale E. Schindler, Robert J. Olson, James F. Kitchell, Chris Boggs, and Ray Hilborn. 2002. Alternative fisheries and the predation rate of yellowfin tuna in the eastern Pacific Ocean. Ecol. Appl., 12 (3): 724-734.

Olson, Robert J., and Felipe Galván Mangaña. 2002. Food habits and consumption rates of common dolphinfish (*Coryphaena hippurus*) in the eastern Pacific Ocean. U.S. Nat. Mar. Fish. Serv., Fish. Bull., 100 (2): 279-298.

Pabst, D. A., T. M. Harradine, W. A. McLellan, M. M. Barbieri, E. M. Meagher, and M. D. Scott. 2001. Infrared thermography as a tool to assess thermal function of the bottlenose dolphin (*Tursiops truncatus*) dorsal fin [abstract]. Amer. Zool., 41 (6): 1548.

ADMINISTRATION

Mr. Shelton J. Harley, a graduate of the University of Auckland and a Ph.D. candidate at Dalhousie University, Halifax, Nova Scotia, Canada, was hired for the La Jolla staff on April 1, 2002. He has taken the position of Dr. George M. Watters, who resigned in September 2001.

Mr. Roberto Yau resigned on April 30, 2002, after one year of service as the Maintenance Officer for the Achotines Laboratory.

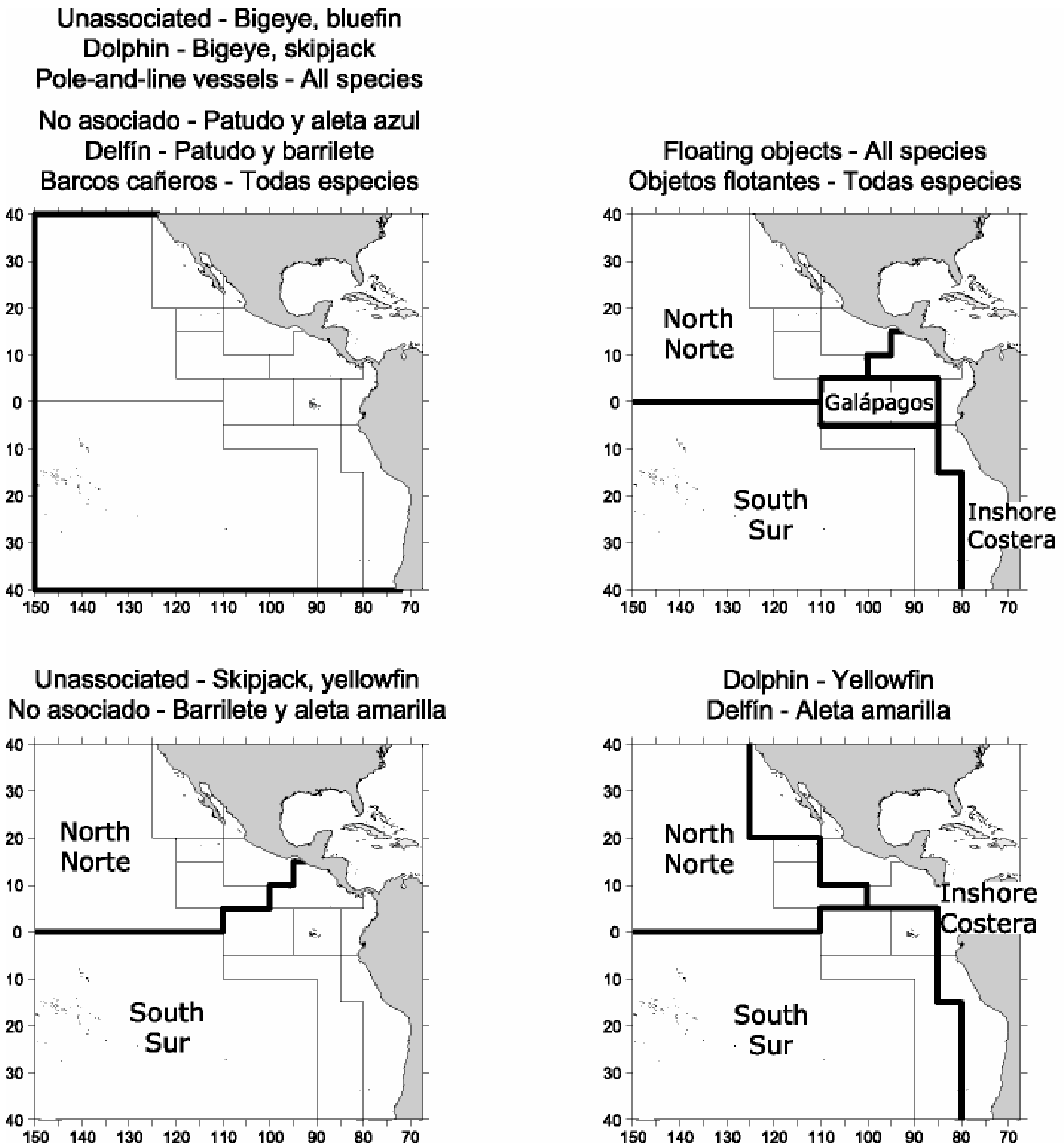

FIGURE 1. Spatial extents of the fisheries defined by the IATTC staff for stock assessment of yellowfin, skipjack, and bigeye in the EPO. The thin lines indicate the boundaries of the 13 length-frequency sampling areas, and the bold lines the boundaries of the fisheries.
FIGURA 1. Extensión especial de las pesquerías definidas por el personal de la CIAT para la evaluación de los stocks de atún aleta amarilla, barrilete, y patudo en el OPO. Las líneas delgadas indican los límites de las 13 zonasde muestreo de frecuencia de tallas, y las líneas gruesas los límites de las pesquerías.

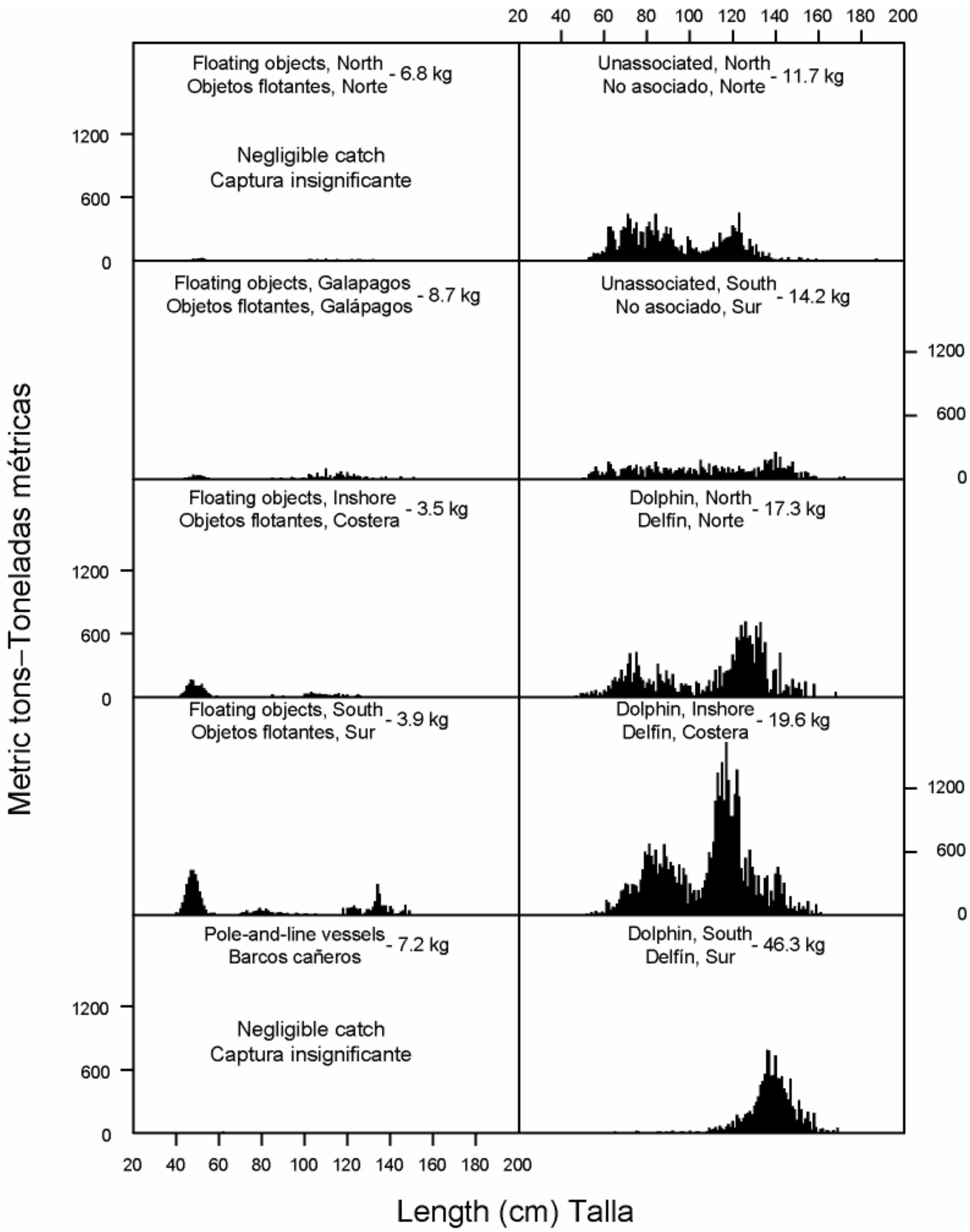

FIGURE 2a. Estimated size compositions of the yellowfin caught in each fishery of the EPO during the first quarter of 2002. The average weights of the fish in the samples are given at the tops of the panels.
FIGURA 2a. Composición por tallas estimada para el aleta amarilla capturado en cada pesquería del OPO durante el primero trimestre de 2002. En cada recuadro se detalla el peso promedio de los peces en las muestras.

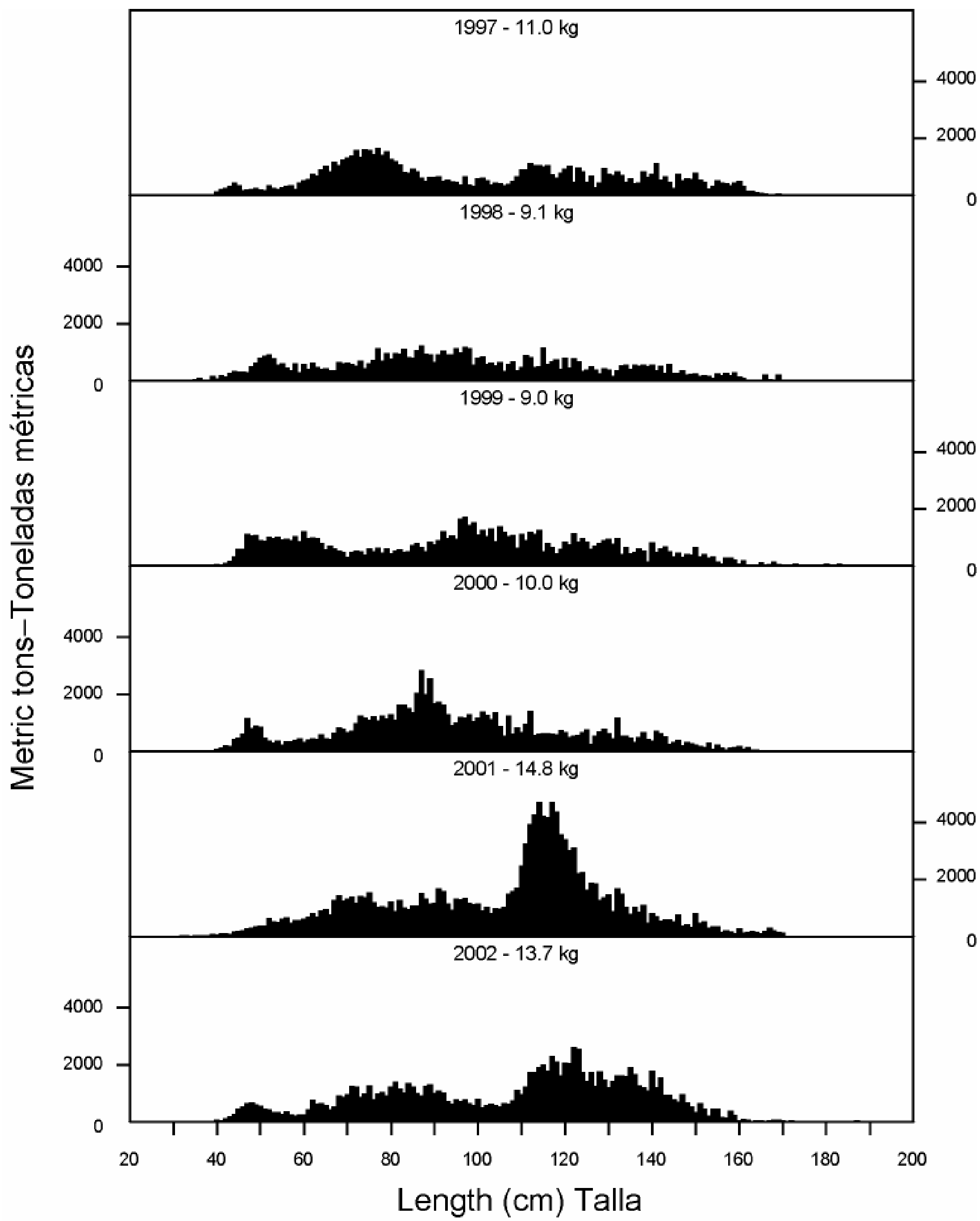

FIGURE 2b. Estimated size compositions of the yellowfin caught in the EPO during the first quarter of 1997-2002. The average weights of the fish in the samples are given at the tops of the panels.

FIGURA 2b. Composición por tallas estimada para el aleta amarilla capturado en el OPO en el primero trimestre de 1997-2002. En cada recuadro se detalla el peso promedio de los peces en las muestras.

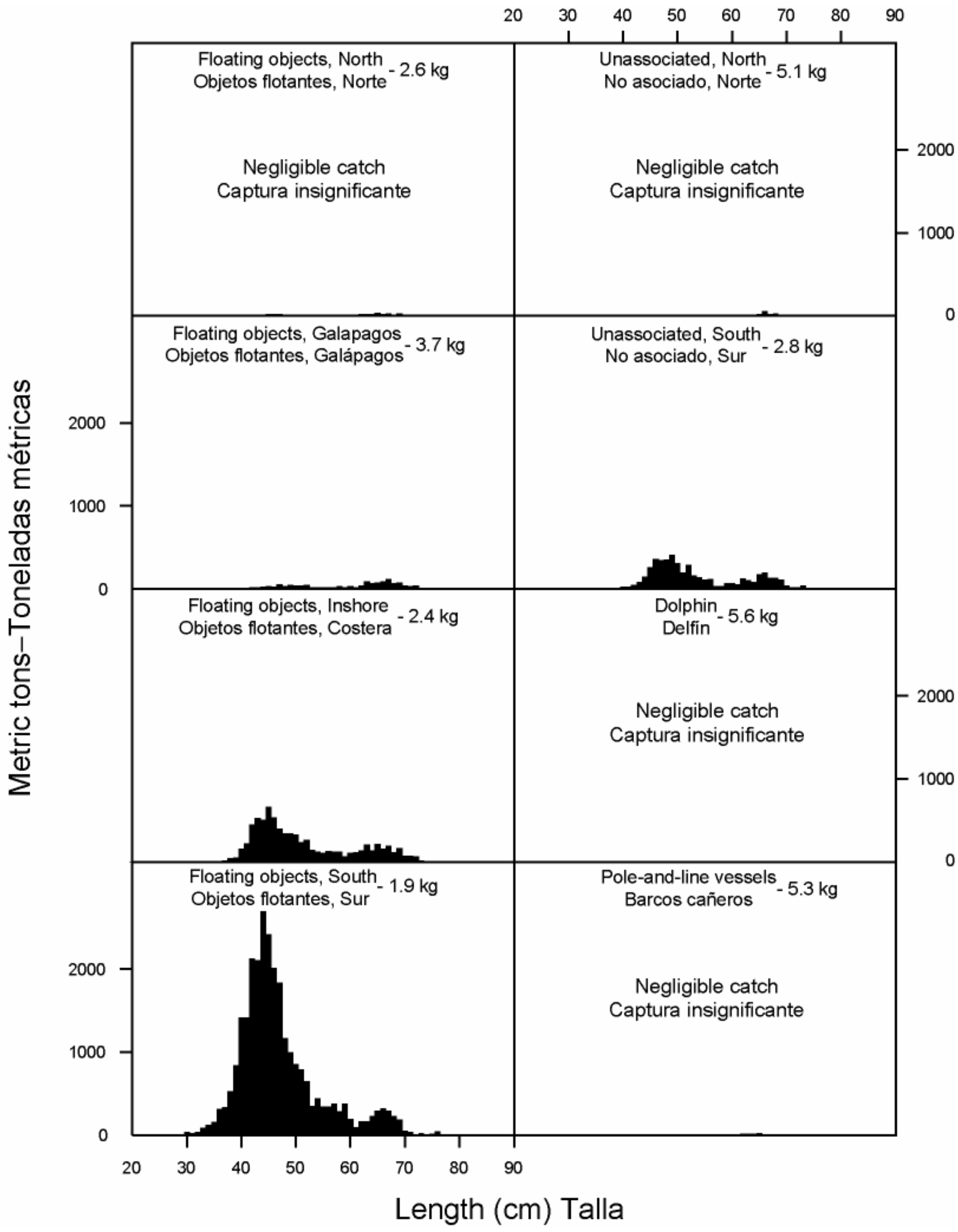

FIGURE 3a. Estimated size compositions of the skipjack caught in each fishery of the EPO during the first quarter of 2002. The average weights of the fish in the samples are given at the tops of the panels.
FIGURA 3a. Composición por tallas estimada para el barrilete capturado en cada pesquería del OPO durante el primero trimestre de 2002. En cada recuadro se detalla el peso promedio de los peces en las muestras.

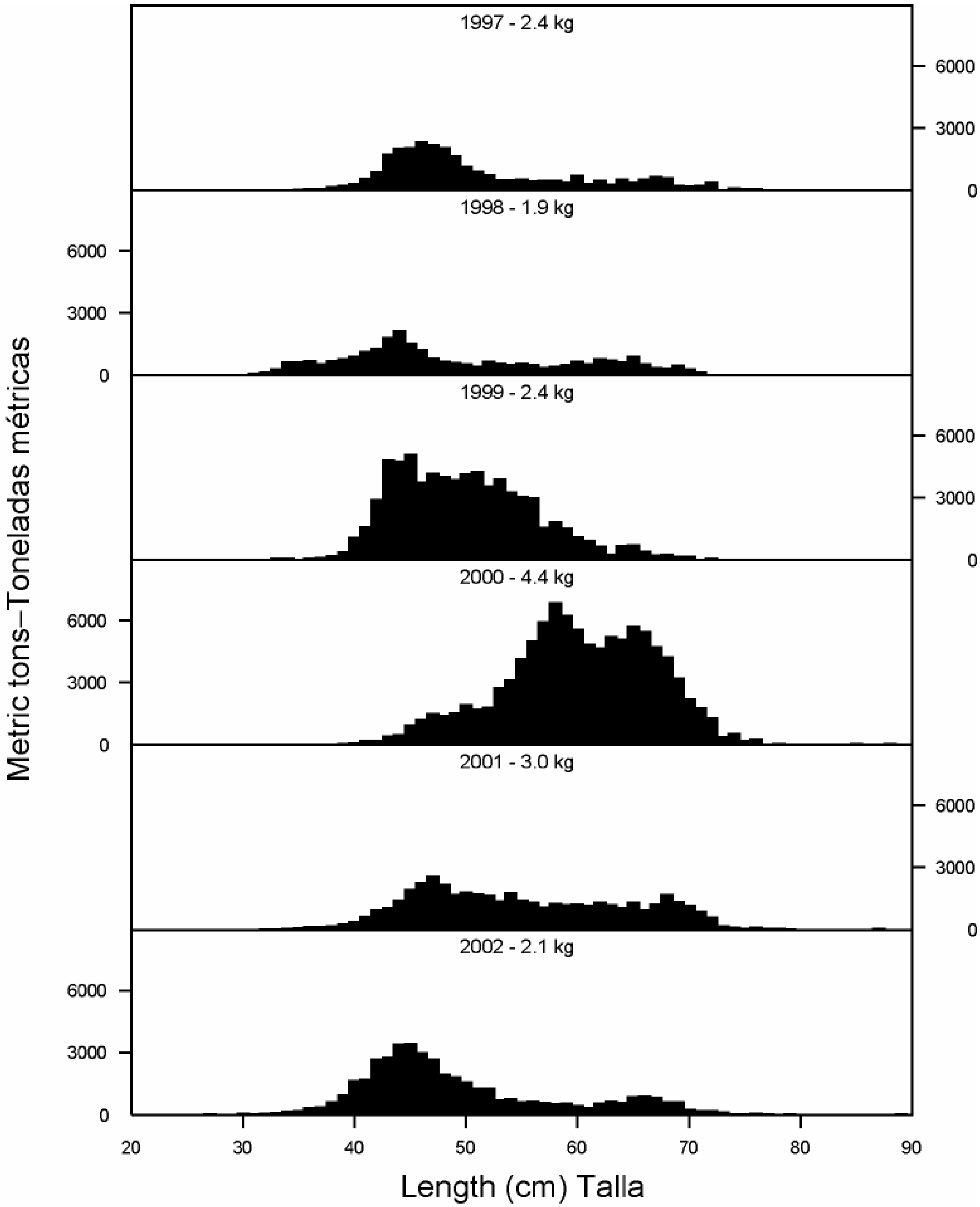

FIGURE 3b. Estimated size compositions of the skipjack caught in the EPO during the first quarter of 1997-2002. The average weights of the fish in the samples are given at the tops of the panels.

FIGURA 3b. Composición por tallas estimada para el barrilete capturado en el OPO en el primero trimestre de 1997-2002. En cada recuadro se detalla el peso promedio de los peces en las muestras.

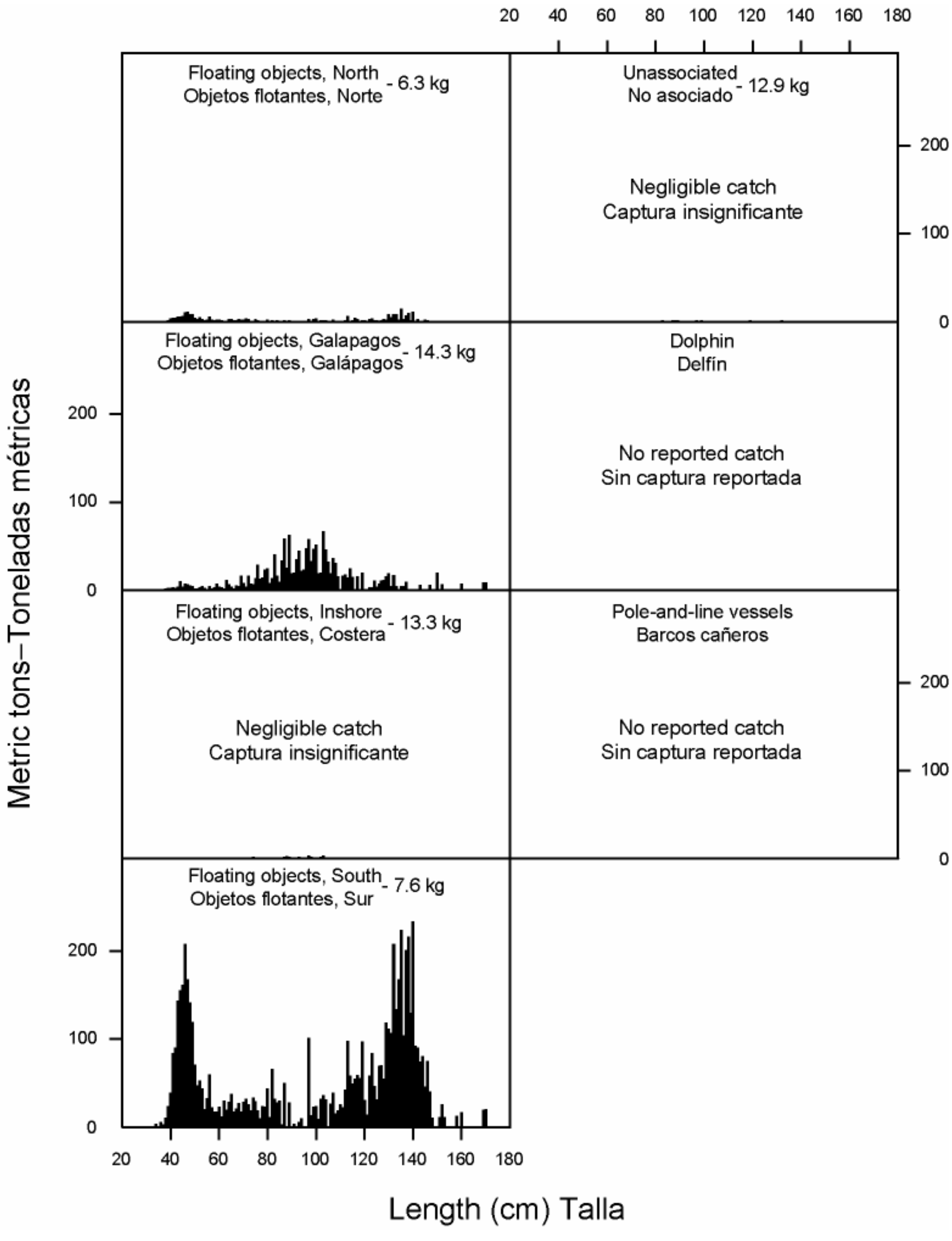

FIGURE 4a. Estimated size compositions of the bigeye caught in each fishery of the EPO during the first quarter of 2002. The average weights of the fish in the samples are given at the tops of the panels.

FIGURA 4a. Composición por tallas estimada para el patudo capturado en cada pesquería del OPO durante el primero trimestre de 2002. En cada recuadro se detalla el peso promedio de los peces en las muestras.

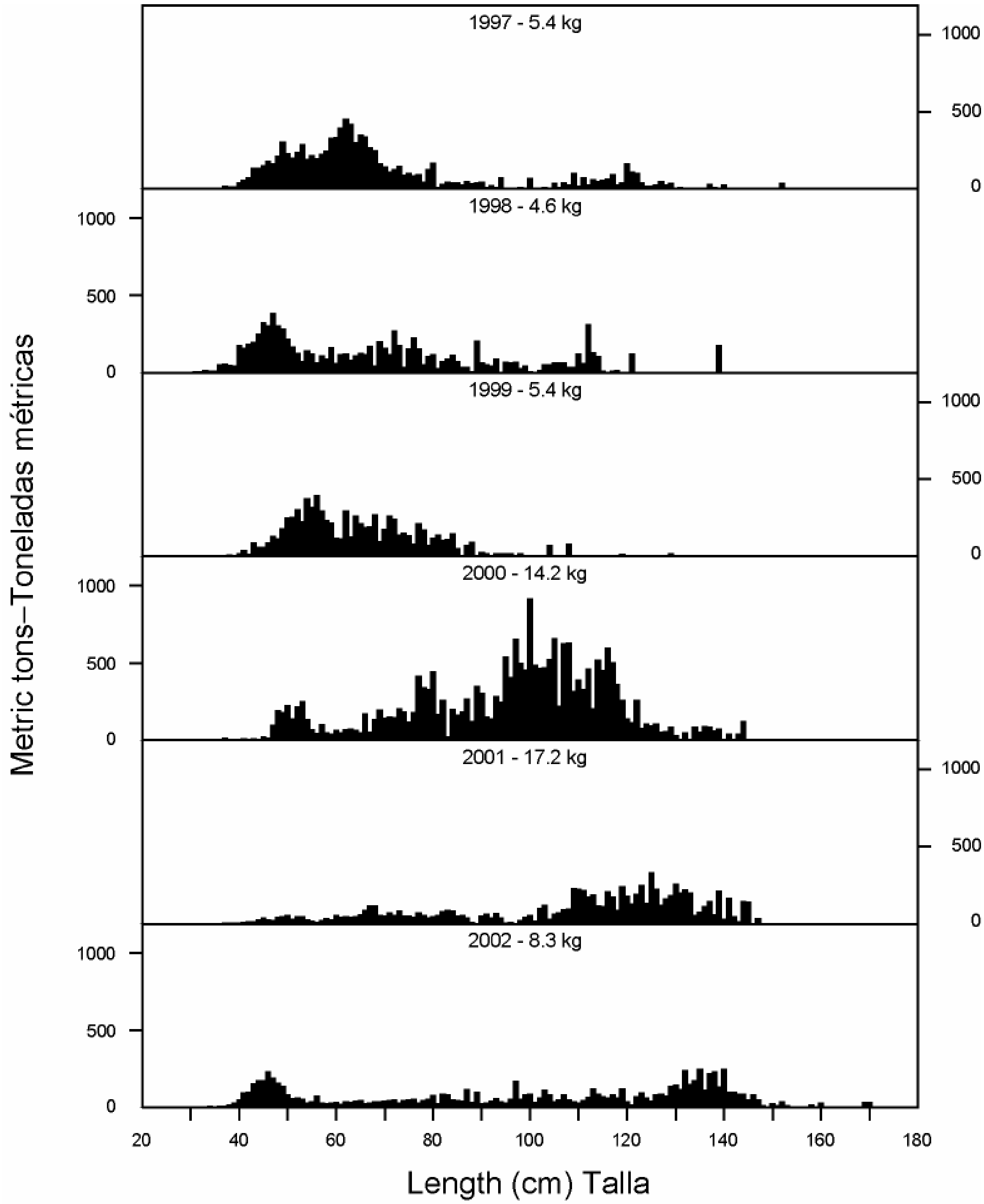

FIGURE 4b. Estimated size compositions of the bigeye caught in the EPO during the first quarter of 1997-2002. The average weights of the fish in the samples are given at the tops of the panels.

FIGURA 4b. Composición por tallas estimada para el patudo capturado en el OPO en el primero trimestre de 1997-2002. En cada recuadro se detalla el peso promedio de los peces en las muestras.

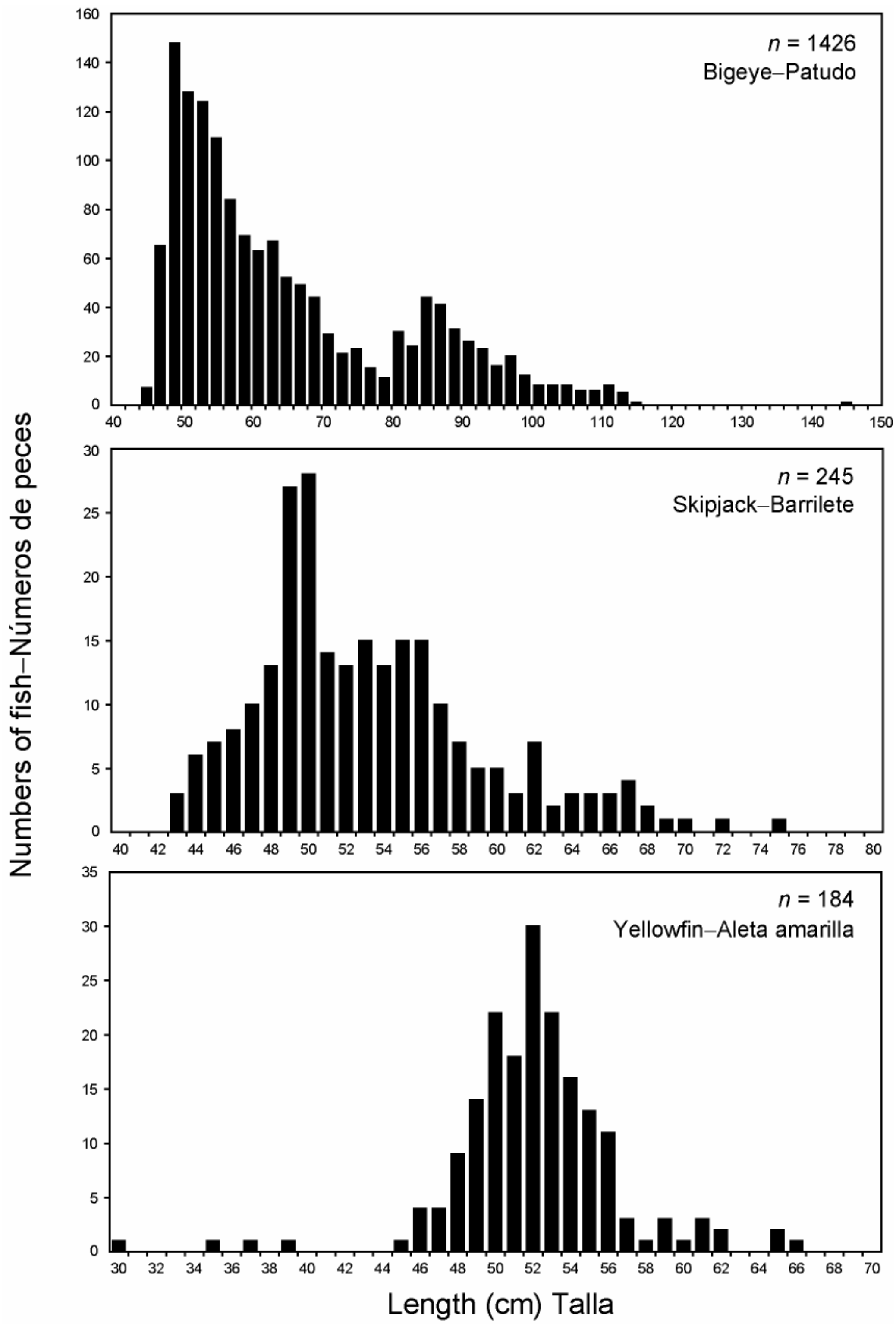

FIGURE 5. Length frequencies of tagged tunas released in the eastern Pacific Ocean during March-May 2002.
FIGURA. 5. Frecuencias de talla de atunes marcados liberados en el Océano Pacífico oriental durante Marzo-Mayo 2002.

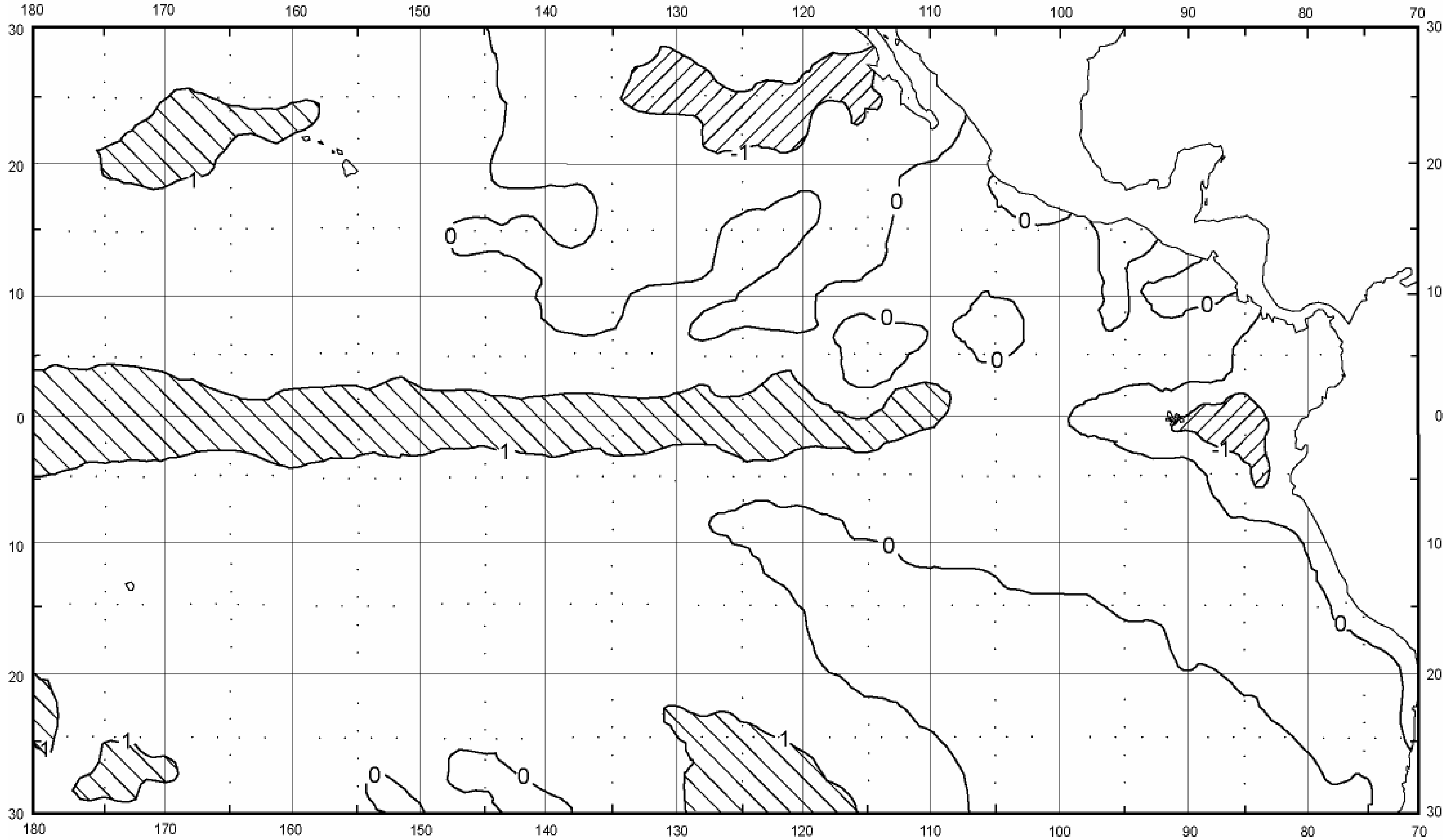

FIGURE 6. Sea-surface temperature (SST) anomalies (departures from long-term normals) for June 2002, based on data from fishing boats and other types of commercial vessels.

FIGURA 6. Anomalías (variaciones de los niveles normales a largo plazo) de la temperatura superficial del mar (TSM) en junio de 2002, basadas en datos tomados por barcos pesqueros y otros buques comerciales.

TABLE 1. Preliminary estimates of the numbers and carrying capacities, in cubic meters, of purse seiners and baitboats operating in the EPO in 2002 by flag, gear, and size class. 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; PL = pole-and-line vessel.
TABLA 1. Estimaciones preliminares del número de buques cerqueros y de carnada que pescan en el OPO en 2002, y de la capacidad de acarreo de los mismos, en metros cúbicos, por bandera, arte de pesca, y clase de arqueo. Se incluye cada barco 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; PL = cañero.

Flag Bandera	Gear Arte	Size class—Clase de arqueo 1	2	3	4	5	6	Total	Capacity Capacidad
					Number—Número				
Belize—Belice	PS	-	-	-	-	-	1	1	809
Bolivia	PS	-	-	-	-	-	7	7	7,328
Colombia	PS	-	-	2	1	2	5	10	7,397
Ecuador	PS	-	6	12	11	7	37	73	47,287
	PL	1	-	-	-	-	-	1	32
España—Spain	PS	-	-	-	-	-	5	5	12,137
Guatemala	PS	-	-	-	-	-	4	4	7,640
Honduras	PS	-	-	-	-	-	2	2	1,798
México	PS	-	-	4	4	11	42	61	53,581
	PL	1	3	6	-	-	-	10	1,259
Nicaragua	PS	-	-	-	-	-	1	1	1,229
Panamá	PS	-	-	2	2	-	7	11	10,746
Perú	PS	-	-	-	-	-	1	1	902
El Salvador	PS	-	-	-	-	-	2	2	4,469
U.S.A.—EE.UU.	PS	-	-	1	-	2	5	8	7,362
Venezuela	PS	-	-	-	-	-	24	24	30,577
Vanuatú	PS	-	-	-	-	1	4	5	5,213
Unknown—Desconocida	PS	-	-	-	-	-	1	1	486
All flags—	PS	-	6	21	18	23	146	214	
Todas banderas	PL	2	3	6	-	-	-	11	
	PS + PL	2	9	27	18	23	146	225	
					Capacity—Capacidad				
All flags—	PS	-	604	3,845	5,092	10,088	177,617	197,246	
Todas banderas	BB	85	293	913	-	-	-	1,291	
	PS + BB	85	897	4,758	5,092	10,088	177,617	198,537	

TABLE 2. Changes in the IATTC fleet list recorded during the second quarter of 2002. PS = purse seine; UNK = unknown.
TABLA 2. Cambios en la flota observada por la CIAT registrados durante el segundo trimestre de 2002. PS = cerquero; UNK = desconocido.

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 entries—Nuevos ingresos					
Blue Tuna	Bolivia	PS	1,102		
Aguila Descalza	México	PS	410		
Buena Ventura I	México	PS	999		
Buena Ventura II	México	PS	999		
Re-entries—Reingresos					
				Now—Ahora	
Mediterraneo	Ecuador	PS	300	*Maria Isabel*	
Victor Andres	Ecuador	PS	115		
Chac Mool	México	PS	1,190		
Garabito	México	PS	1,118	*Maria Antonieta*	
Miriams	Perú	PS	902	*Danielle D.*	
Changes of name or flag—Cambios de nombre or pabellón					
				Now—Ahora	
Pamela Ann	Nicaragua	PS	1,229	*Capt. Joe Jorge*	Panamá
Don Italo	UNK	PS	486		Bolivia
Vessel removed from the fleet—Buque retirado de la flota					
Victoria A	Ecuador	PS	662	Sank—Hundido	

TABLE 3. Preliminary estimates of the retained catches of tunas in the EPO from January 1 through July 1, 2002, 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 1 julio de 2002, por especie y bandera del buque, en toneladas métricas.

Flag	Yellowfin		Skipjack	Bigeye	Bluefin	Bonito	Albacore	Black skipjack	Other[1]	Total	Percentage of total
	CYRA	Outside									
Bandera	Aleta amarilla		Barrilete	Patudo	Aleta azul	Bonito	Albacora	Barrilete negro	Otras[1]	Total	Porcentaje del total
	ARCAA	Exterior									
Colombia	14,334	2,736	1,314	134	-	-	-	-	-	18,518	5.7
Ecuador	17,313	2,271	44,141	8,068	-	-	-	199	21	72,013	22.0
España—Spain	2,419	840	10,115	2,258	-	-	-	-	-	15,632	4.8
México	83,813	1,547	3,262	-	300	-	-	195	-	89,117	27.2
Panamá	7,387	748	3,850	561	-	-	-	-	-	12,546	3.8
U.S.A.—EE.UU.	639	401	2,477	1,100	-	-	-	209	19	4,845	1.5
Venezuela	54,998	7,177	2,630	232	-	-	-	-	-	65,037	19.9
Vanuatú	3,715	180	3,732	1,053	-	-	-	-	-	8,680	2.6
Other—Otros[2]	17,454	3,755	16,760	3,098	-	-	-	-	-	41,067	12.5
Total	202,072	19,655	88,281	16,504	300	-	-	603	40	327,455	

[1] Includes mackerel, sharks, other tunas, and miscellaneous fishes
[1] Incluye caballas, tiburones, otros túnidos, y peces diversos
[2] Includes Belize, Bolivia, El Salvador, Guatemala, Honduras, Nicaragua, Peru, and unknown. This category is used to avoid revealing the operations of individual vessels or companies.
[2] Incluye Belice, Bolivia, El Salvador, Guatemala, Honduras, Nicaragua, Perú, y desconocida. 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 during the period of January 1-March 30, based on fishing vessel logbook information.
TABLA 4. Captura registrada y captura por día de pesca[1] CPDP) de aleta amarilla en el OPO, en toneladas métricas, durante el período de1 de enero-30 de marzo, basado en información de los cuadernos de bitácora de buques pesqueros.

Area	Fishery statistic Estadística de pesca	Year-Año					
		1997	1998	1999	2000	2001	2002[2]
Purse seine—Red de cerco							
North of 5°N Al norte de 5°N	Catch—Captura	37,300	35,400	49,000	38,700	40,600	47,400
	CPDF—CPDP	17.5	14.2	15.2	16.0	23.1	34.6
South of 5°N Al sur de 5°N	Catch—Captura	26,000	13,100	9,300	26,600	59,700	20,300
	CPDF—CPDP	9.6	4.2	5.5	8.8	17.5	6.8
Total	Catch—Captura	63,300	48,500	58,300	65,300	100,300	67,700
	CPDF—CPDP	14.3	11.5	13.7	13.1	19.8	26.3
Annual total Total anual	Catch—Captura	210,500	189,700	191,300	203,100	267,100	
Pole and line—Cañero							
Total	Catch—Captura	500	800	100	100	900	100
	CPDF—CPDP	2.0	3.1	0.9	0.9	4.6	1.2
Annual total Total anual	Catch—Captura	3,500	2,600	1,600	2,100	3,100	

1 Purse-seiners, Class-6 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 de las Clase 6; 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 during the period of January 1-March 30, based on fishing vessel logbook information.
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-30 de marzo, basado en información de los cuadernos de bitácora de buques pesqueros.

Area	Fishery statistic Estadística de pesca	Year-Año 1997	1998	1999	2000	2001	2002[2]
Purse seine—Red de cerco							
North of 5°N Al norte de 5°N	Catch—Captura	2,500	1,900	5,600	12,400	3,900	900
	CPDF—CPDP	1.2	0.8	1.7	5.1	2.2	0.7
South of 5°N Al sur de 5°N	Catch—Captura	15,000	17,200	35,700	49,000	28,800	31,100
	CPDF—CPDP	5.5	5.5	21.2	16.3	8.4	10.4
Total	Catch—Captura	17,500	19,100	41,300	61,400	32,700	32,000
	CPDF—CPDP	4.9	5.0	18.6	14.0	7.7	10.1
Annual total Total anual	Catch—Captura	109,100	102,000	163,100	125,500	102,200	
Pole and line—Cañero							
Total	Catch—Captura	100	200	<100	100	<100	200
	CPDF—CPDP	0.6	0.7	0.3	0.8	0.1	1.7
Annual total Total anual	Catch—Captura	2,300	1,000	1,800	100	200	

1 Purse-seiners, Class-6 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 de las Clase 6; 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 during the period of January 1-March 30, based on purse-seine vessel logbook information.
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-30 de marzo, basado en información de los cuadernos de bitácora de buques cerqueros.

Fishery statistic—Estadística de pesca	Year—Año					
	1997	1998	1999	2000	2001	2002[2]
Catch—Captura	7,300	5,300	4,500	15,900	8,600	6,900
CPDF—CPDP	2.5	1.7	1.7	5.1	2.4	2.3
Total annual catch—Captura total anual	35,000	20,000	22,000	47,400	40,500	

1 Class-6 vessels only. The catch values are rounded to the nearest 100, and the CPDF values to the nearest 0.1.
1 Buques de las Clase 6 solamente. 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. Preliminary data on the sampling coverage of trips by vessels with capacities greater than 363 metric tons by the IATTC, Ecuadorian, Mexican, and Venezuelan programs during the second quarter of 2002. The numbers in parentheses indicate cumulative totals for the year.
TABLA 7. Datos preliminares de la cobertura de muestreo de viajes de buques con capacidad más que 363 toneladas métricas por los programas de la CIAT, Ecuador, México, y Venezuela durante el segundo trimestre de 2002. Los números en paréntesis indican totales acumulados para el año.

Fleet	Number of trips		Trips sampled by program						Percent sampled	
			IATTC		National		Total			
Flota	Número de viajes		Viajes muestreados por programa						Porcentaje muestreado	
			CIAT		Nacional		Total			
Belize	1	(3)	1	(3)			1	(3)	100.0	(100.0)
Bolivia	11	(25)	9	(22)			9	(22)	81.8	(88.0)
Colombia	8	(19)	8	(19)			8	(19)	100.0	(100.0)
Ecuador	53	(136)	35	(91)	18	(45)	53	(136)	100.0	(100.0)
España—Spain	6	(18)	6	(18)			6	(18)	100.0	(100.0)
Guatemala	5	(14)	5	(14)			5	(14)	100.0	(100.0)
Honduras	3	(7)	3	(7)			3	(7)	100.0	(100.0)
México	48	(106)	24	(52)	24	(54)	48	(106)	100.0	(100.0)
Nicaragua	1	(3)	1	(3)			1	(3)	100.0	(100.0)
Panamá	7	(16)	7	(16)			7	(16)	100.0	(100.0)
Perú	1	(2)	1	(2)			1	(2)	100.0	(100.0)
El Salvador	4	(8)	4	(8)			4	(8)	100.0	(100.0)
U.S.A.—EE.UU.	4	(9)	4	(9)			4	(9)	100.0	(100.0)
Venezuela	39	(93)	16	(46)	23	(47)	39	(93)	100.0	(100.0)
Vanuatu[1]	6	(15)	5	(13)			5	(13)	83.3	(86.7)
Unknown—Desconocido	0	(1)	0	(0)			0	(0)	-	(0.0)
Total	197	(475)[2]	129	(323)	65	(146)	194	(469)[2]	98.5	(98.7)

[1] The government of Vanuatu has determined that one of its vessels is not required to participate in the IDCP.
[1] El gobierno de Vanuatu determinó que uno de sus buques no necesita participar en el PICD.
[2] Includes 68 trips that began in late 2001 and ended in 2002
[2] Incluye 68 viajes iniciados a fines de 2001 y completados en 2002

TABLE 8. Oceanographic and meteorological data for the Pacific Ocean, January-June 2002. The values in parentheses are anomalies.
TABLA 8. Datos oceanográficos y meteorológicos del Océano Pacífico, enero-junio 2002. Los valores en paréntesis son anomalías.

Month—Mes	**1**	**2**	**3**	**4**	**5**	**6**
SST—TSM, 0°-10°S, 80°-90°W (°C)	23.6 (-0.9)	26.1 (0.0)	27.5 (1.1)	26.5 (1.1)	24.8 (0.5)	22.7 (-0.4)
SST—TSM, 5°N-5°S, 90°-150°W (°C)	25.1 (-0.5)	26.2 (-0.2)	27.2 (0.1)	27.6 (0.2)	27.2 (0.2)	27.1 (0.7)
SST—TSM, 5°N-5°S, 120°-170°W (°C)	26.5 (0.0)	27.0 (0.3)	27.3 (0.2)	27.9 (0.30	28.2 (0.4)	28.4 (0.9)
SST—TSM, 5°N-5°S, 150W°-160°E (°C)	28.8 (0.7)	28.8 (0.8)	28.7 (0.6)	29.1 (0.7)	29.5 (0.8)	29.6 (1.0)
Thermocline depth—Profundidad de la termoclina, 0°, 80°W (m)	40	30	60	70	40	40
Thermocline depth—Profundidad de la termoclina, 0°, 110°W (m)	60	110	80	50	40	60
Thermocline depth—Profundidad de la termoclina, 0°, 150°W (m)	180	170	130	150	130	120
Thermocline depth—Profundidad de la termoclina, 0°, 180°W (m)	170	170	170	180	150	160
Sea level—Nivel del mar, Baltra, Ecuador (cm)	173.7	--	--	--	--	--
	(-7.0)	--	--	--	--	--
Sea level—Nivel del mar, La Libertad, Ecuador (cm)	222.4	237.1	233.7	231.4	231.7	228.2
	(-8.2)	(5.4)	(3.1)	(0.6)	(-0.6)	(-4.7)
Sea level—Nivel del mar, Callao, Perú (cm)	94.6	106.0	112.8	105.6	106.8	100.9
	(-16.9)	(-8.1)	(-1.9)	(-8.9)	(-6.7)	(-11.1)
SOI—IOS	0.4	0.9	-0.9	-0.4	-1.2	-0.7
SOI*—IOS*	1.53	-0.12	-2.37	3.86	-4.11	2.40
NOI*—ION*	2.85	2.94	1.66	0.23	-0.13	0.50