INTER-AMERICAN TROPICAL TUNA COMMMISSION
COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL

QUARTERLY REPORT—INFORME TRIMESTRAL

April-June 2016—Abril-Junio 2016

The Quarterly Report of the Inter-American Tropical Tuna Commission is an informal account 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 de la Comisión Interamericana del Atún Tropical es un relato informal 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.

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DIRECTORSHIP OF THE IATTC

We are pleased to announce that Dr. Guillermo A. Compeán's term as Director of the IATTC was extended for four more years at the 90th meeting of the IATTC.

MEETINGS

IATTC meetings

The 7th meeting of the Scientific Advisory Committee was held in La Jolla, California, USA, on 9-13 May 2016. The following background papers were presented at the meeting:

SAC-07-03a The Fishery for Tunas and Billfishes in the Eastern Pacific Ocean in 2015

SAC-07-03d An Exploration into Japanese Size Data of Tropical Tuna Species because of a Prominent Size-Frequency Residual Pattern in the Stock Assessment Model, by Keisuke Satoh, Carolina V. Minte-Vera, Nickolas W. Vogel, Alexandre Aires-da-Silva, Cleridy E. Lennert-Cody, Mark N. Maunder, Hiroaki Okamoto, Koji Uosaki, Takayuki Matsumoto, Yasuko Semba, and Tomoyuki Ito

SAC-O7-03e The Fishery on Fish-Aggregating Devices (FADs) in the Eastern Pacific Ocean–Update, by Martín Hall and Marlon H. Román

SAC-07-04a Changes in Longline Size-Frequency Data and Their Effects on the Stock Assessment Models for Yellowfin and Bigeye Tunas, by Carolina V. Minte-Vera, Alexandre Aires-da-Silva, Keisuke Satoh, and Mark N. Maunder

SAC-07-05a Status of Bigeye Tuna in the Eastern Pacific Ocean in 2015 and Outlook for the Future, by Alexandre Aires-da-Silva, Carolina Minte-Vera, and Mark N. Maunder

SAC-07-05a(i) SPC Pacific-wide Assessment and CPUE Analysis

SAC-07-05b Status of Yellowfin Tuna in the Eastern Pacific Ocean in 2015 and Outlook for the Future, by Carolina V. Minte-Vera, Alexandre Aires-Da-Silva, and Mark N. Maunder

SAC-07-05c Status of Skipjack Tuna in the Eastern Pacific Ocean in 2015, by Mark N. Maunder

SAC-07-05d Updated Assessment and Management of Pacific Bluefin Tuna, by Mark N. Maunder

SAC-07-06a(i) Exploratory Stock Assessment of Dorado (*Coryphaena hippurus*) in the Southeastern Pacific Ocean (draft), by Alexandre Aires-da-Silva, Juan L. Valero, Mark. N. Maunder, Carolina Minte-Vera, Cleridy Lennert-Cody, Marlon H. Román, Jimmy Martínez-Ortiz, Edgar J. Torrejón-Magallanes, and Miguel N. Carranza

SAC-07-06a(ii) Exploratory Management Strategy Evaluation (MSE) of Dorado (*Coryphaena hippurus*) in the Southeastern Pacific Ocean, by Juan L. Valero, Alexandre Aires-da-Silva, Mark N. Maunder, Carolina Minte-Vera, Jimmy Martínez-Ortiz, Edgar J. Torrejón-Magallanes, and Miguel N. Carranza

SAC-07-06b(i) Updated Stock Status Indicators for Silky Sharks in the Eastern Pacific Ocean (1994-2015), by Cleridy Lennert-Cody, Alexandre Aires-da-Silva, Mark N. Maunder, and Marlon H. Román

SAC-07-06b(ii) An Inventory of Sources of Data in Central America on Shark Fisheries Operating in the Eastern Pacific Ocean: Metadata Report compiled, by Salvador Siu and Alexandre Aires-da-Silva

SAC-07-06b(iii) Challenges to Collecting Shark Fishery Data in the Eastern Pacific Ocean, and Recommendations for Improvement: Data Collection Standards and Procedures

SAC-07-06b(iv) Mitigation Measures for Sharks

SAC-07-07a Rev) Current and Planned Activities of the IATTC Staff

SAC-07-07b Ecosystem Considerations

SAC-07-07c Review of Research at the Achotines Laboratory, by Daniel Margulies, Vernon P. Scholey, Jeanne B. Wexler, and Maria S. Stein

SAC-07-07d Research Projects with Some Extra-Budgetary Funding

SAC-07-07e Preliminary Evaluation of Several Options for Reducing Bigeye Tuna Catches, by Cleridy E. Lennert-Cody, Mark N. Maunder, Alex Aires-da-Silva, Marlon H. Román, and Vardis M. Tsontos

SAC-07-07f(i) Changes in the Purse-seine Fleet Fishing on Floating Objects and the Need to Monitor Small Vessels, by Marlon H. Román, Cleridy Lennert-Cody, Mark N. Maunder, Alexandre Aires-da-Silva, and Nick W Vogel

SAC-07-07f(ii) Evaluation of the Declining Catch Per Set in the Purse-seine Fishery on Floating Objects in the Eastern Pacific Ocean, by Mark N. Maunder and Alexandre Aires-da-Silva

SAC-07-07g Application of Harvest Control Rules for Tropical Tunas in the Eastern Pacific Ocean, by Mark N. Maunder and Richard B. Deriso

SAC-07-07h Current and Future Research on Management Strategy Evaluation (MSE) for Tunas and Related Species in the Eastern Pacific Ocean, by Mark N. Maunder, Carolina V. Minte-Vera, Alexandre Aires-da-Silva, and Juan L. Valero

SAC-07-08 Recommendations by the Staff for Conservation Measures in the Eastern Pacific Ocean, 2016

Also, the following reports were made available to the attendees:

SAC-07 INF A(aI) Informe sobre el Programa de Muestreadores Científicos a bordo en Palangreros de Superficie con Pabellón Español en el Área de Convenio de la Inter-American Tropical Tuna Commission en el Año 2015 by Equipo de Túnidos y Especies Afines (Grandes Pelágicos Oceánicos) Instituto Español de Oceanografía

SAC-07- INF A(aII) Informe Anual 2015 de la UE-España by Programa de Túnidos y Especies Afines (Pelágicos Oceánicos) Instituto Español de Oceanografía1

SAC-07 INF-A(b) Report of Chinese Taipei

SAC-07 INF-A(c) Programa de Observidores a borde de la Flota Palengrera en el Océano Pacífico (México)

SAC-07 INF-A(d) Annual Report Relating to At-Sea Observer Coverage in Accordance with Resolution C-11-08 (Belize)

SAC-07 INF A(e) CPC Observer Annual Report for the Year 2015 in the IATTC Convention Area (China)

SAC-07 INF A(f) Report of Japan's Scientific Observer Program for Tuna Longline Fishery in the Convention Area of Inter-American Tropical Tuna Commission in 2015 calendar year

SAC-07 INF A(g) 2015 Annual Scientific Observer Report for Korean Tuna Longline Fishery in the IATTC Convention Area

SAC-07 INF A(h) United States Summary of 2015 Observer Data per Resolution C-11-08: Resolution On Scientific Observers for Longline Vessels

SAC-07 INF A(i) Medida C-11-08: Proceso para un Mejor Cumplimiento de las Resoluciones Adoptadas por la Comisión (Ecuador)

SAC-07 INF A(j) Costa Rica

SAC-07 INF A(k) Informe Anual de Venezuela 2016

The following additional reports were presented at the meeting;

SAC-07 INF C(a) Executive Summary of the 2016 Pacific Bluefin Tuna Stock Assessment (International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean)

SAC-07 INF C(b) Update on Seabird Distribution in the Eastern Pacific and Best Practice Advice to Reduce Bycatch of Seabirds in the Convention Area, by Esteban Frere, Lisa Ballance, Trevor Joyce, and Marco Favero

SAC-07 INF C(c) The use of echo-sounder buoys in purse seine fleets fishing with DFADs in the eastern Pacific Ocean, by G. Moreno, J. Murua, and V. Restrepo

SAC-07 INF C(d) Description of Reported Catch Data for Non-target Species: Does Sufficient Data Exist to Produce a Comprehensive Ecological Risk Assessment?, by Leanne Duffy, Cleridy Lennert-Cody, Nickolas Vogel, Joanne Boster, and Joydelee Marrow

SAC-07 INF C(e) Summary report of the International Workshop on Application of Electronic Monitoring Systems in Tuna Longline Fisheries. International Seafood Sustainability Foundation, Technical Report 2016-07

SAC-07 INF C(f) 1 Towards Acoustic Discrimination of Tuna Species at FADs, by G. Moreno, G. Boyra, I. Sancristobal, J. Murua, and V. Restrepo

SAC-07 INF C(g) 2 Towards Acoustic Discrimination of Tuna Species at FADs, by G. Moreno, G. Boyra, I. Sancristobal, J. Murua, and V. Restrepo

SAC-07 INF C(h) Evaluating Potential Biodegradable Twines for Use in the Tropical Tuna Fishery, by J. Lopez, J.M. Ferarios, J. Santiago, O.G. Alvarez, G. Moreno, and H. Murua

SAC-07 INF C(i) Review of the Spanish Fish Aggregating Device Management Plan: Implementation, Evolution and Recommendations, by M. Soto, A. Justel-Rubio, and J. Lopez

SAC-07 INF C(j) Towards a Tropical Tuna Buoy-derived Abundance Index (TT-BAI), by J. Santiago, J. Lopez, G. Moreno, H. Murua, I. Quincoces, and M. Soto

The 17th meeting of the Permanent Working Group on Fleet Capacity was held in La Jolla, California. USA, on 14 May 2016. The following background papers were presented at the meeting:

CAP-17-03 Utilization of Vessel Capacity under Resolutions C-02-03, C-12-06, and C-12-08

CAP-17 INF-A REV Pending Capacity Claims, Disputes, Adjustments and Requests

CAP-17 INF-B Fleet Capacity 2015

An *ad hoc* meeting on fish-aggregating devices (FADs) was held in La Jolla, California, USA, on 15 May 2016.

The following IATTC meetings were held in La Jolla, California, USA, during late June and early July 2016:

No.	Meeting	Date(s)
37	Meeting of the Permanent Working Group on Tuna Tracking	20 June
24	Meeting of the Working Group to Promote and Publicize the AIDCP Dolphin-Safe Tuna Certification System	20 June
59	Meeting of the International Review Panel	20 June
33	Meeting of the Parties to the Agreement on the International Dolphin Conservation Program	21 June
7	Meeting of the Committee for the Review of Implementation of Measures Adopted by the Commission	22-23 June
4	Meeting of the Committee on Administration and Finance	23 June
17	Meeting of the Permanent Working Group on Fleet Capacity	24 June
1	Meeting of the *Ad Hoc* Working Group on FADs	26 June
90	Meeting of the IATTC	27 June-1 July

Other meetings

Several members of the IATTC staff participated in all or parts of the 67th Tuna Conference at Lake Arrowhead, California, USA, on 16-19 May 2016. The following talks were given by IATTC staff members (the names of the speakers are in bold face):

Collaborating with the International Seafood Sustainability Foundation seeking practical solutions to reduce fishing mortality on Bigeye Tuna and Silky Sharks in the eastern Pacific Ocean by **Kurt Schaefer** and Daniel Fuller;

Global trophic ecology of yellowfin, bigeye and albacore tunas: can spatial analyses be used to hypothesize predation changes in a warming ocean? by **Leanne M. Duffy,** Jock W. Young, Robert J. Olson, Frederic Ménard, Petra Kuhnert, Heidi R. Pethybridge, Valerie Allain, Monique Simier, John M. Logan, Nicolas Goñi, Michel Potier, Evgeny Romanov, Felipe Galván-Magaña, Matthew J. Lansdell, Michelle Staudinger, Melanie Abecassis, and C. Anela Choy;

Research activities of yellowfin tuna (*Thunnus albacares*) early life history conducted at the IATTC's Achotines Laboratory during 2015-2016 by **Jeanne Wexler**, Dan Margulies, Vernon Scholey, and Maria Stein;

Comparative laboratory studies of food selectivity and feeding behavior of yellowfin (*Thunnus albacares*) and Pacific bluefin (*Thunnus orientalis*) tuna larvae during the first week of feeding by **Maria Stein**, Daniel Margulies, Jeanne Wexler, Vernon Scholey, and Susana Cusatti.

Dr. Daniel Margulies participated in the 40th Larval Fish Conference, held at Solomons Island, Maryland, USA, on 19-23 June 2016. He made the following presentations at the meeting:

Studies of the early life history of large pelagics, with co-authors Vernon Scholey, Jeanne Wexler, and Maria Stein (at the plenary session)

Studies of the larval stages of yellowfin (*Thunnus albacares*) and Pacific bluefin (*Thunnus orientalis*) tuna conducted in Panama and Japan, with co-authors Vernon Scholey, Jeanne Wexler, Maria Stein, Tomoki Honryo, Michio Kurata, Yang-Su Kim, Taro Matsumoto, Amal Biswas, Yasuo Agawa, and Yoshifumi Sawada.

RESEARCH

DATA COLLECTION AND DATABASE PROGRAM

There are two major fisheries for tunas in the eastern Pacific Ocean (EPO; the region east of 150ºW, south of 50ºN, and north of 50°S), the commercial surface fishery and the longline fishery. The catches by the commercial surface fishery are taken almost entirely by purse-seine and pole-and-line vessels based in ports of Western Hemisphere nations. The longline catches are taken almost entirely by vessels registered and based in Far Eastern nations. The staff of the IATTC collects data on the catches by purse-seine and pole-and-line vessels and samples the catches of these vessels at unloading facilities in Las Playas and Manta, Ecuador; Manzanillo and Mazatlán, Mexico; Panama, Republic of Panama; and Cumaná, Venezuela, where it has field offices, and also, to a lesser extent, at other ports. The governments of the nations in which the catches of the longliners that fish in the EPO are registered compile the catch and size composition data for those vessels and make the data, in aggregated form, available to the IATTC staff. The rest of this section deals almost entirely with the surface fisheries.

Compilation of data on the amounts of catch, and on species and length compositions of the catch for the surface fisheries is complicated. Observers accompany all trips of Class-6 purse seiners (vessels with fish-carrying capacities greater than 363 metric tons) that fish in the EPO, and the data that they collect include the locations and dates of each set, the type of each set (dolphin, floating object, or unassociated), the approximate total weights of each species caught in each set, and the wells in which the fish caught in each set are stored. Similar data are obtained from the logbooks of smaller purse seiners and of pole-and-line vessels, although these data may be less accurate or less precise than those collected by the observers. Then, when a vessel unloads its catch, the weight of the contents of each well is made available to the IATTC staff. These "reported catch statistics"—catch statistics obtained from every possible source, including observer records, fishing vessel logbooks, unloading records, and data compiled by governmental agencies—are compiled to provide an estimate of the total amount of tropical tunas (yellowfin, bigeye, and skipjack combined) caught annually by the surface fisheries. In addition, sample data on the species and length compositions of the catch are also obtained when a vessel unloads. The methods for collection of these sample data are described in the IATTC Annual Report for 2000 and in IATTC Stock Assessment Reports 2, 4, 10, 11, 12, and 13. Briefly, the fish in a well of a purse-seine or pole-and-line vessel are selected for sampling only if all of the fish in the well were caught in the same sampling area, during the same calendar month, and by the same type of gear (pole-and-line, or in the same type of set of a Class 1-5 or a Class-6 vessel). These data are then categorized by fishery (Figure 1).

The sample data on species and length compositions of the catch are eventually combined with the reported catch statistics to make the "final" estimates of the catches by species and length- and weight-frequency distributions by species that appear in the IATTC's Stock Assessment Reports, Fishery Status Reports, and papers in outside journals, but this does not take place until two or more months after the end of the calendar year. (If additional information is acquired after the "final" estimates are calculated, that information is used to recalculate the estimates.) Most of the catch statistics that appear in the rest of this report are preliminary, as the calculations cannot be performed until after the end of the year.

IATTC personnel stationed at its field offices collected 420 length-frequency samples from 263 wells and abstracted logbook information for 295 trips of commercial fishing vessels during the second quarter of 2016.

Reported fisheries statistics

Information reported herein is for the EPO, unless noted otherwise. Catch is reported in metric tons (t), vessel capacity in cubic meters (m^3), and effort in days of fishing. Estimates of fisheries statistics with varying degrees of accuracy and precision are available. The most accurate and precise are those made after all available information has been entered into the data base, processed, and verified. 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 after the return of a vessel from a fishing trip. Thus the estimates for the current week are the most preliminary, while those made a year later are much more accurate and precise.

Fleet statistics for the purse seine and pole-and-line fisheries

The lists of vessels authorized to fish for tunas in the EPO are given in the IATTC Regional Vessel Register (http://www.iattc.org/VesselListsENG.htm). The estimated total carrying capacity of the purse-seine and pole-and-line vessels that have or are expected to fish in the EPO during 2016 is about 259,300 m^3 (Table 1). The average weekly at-sea capacity for the fleet, for the weeks ending 10 April through 3 July, was about 185,600 m^3 (range: 164,800 to 213,200 m^3).

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

Catch statistics

The estimated total retained catches, in metric tons, of tropical tunas in the EPO during the period of January-June in 2016, and comparative statistics for 2011-2015, were:

Species	2016	2011-2015			Weekly average,
		Average	Minimum	Maximum	2016
Yellowfin	128,600	131,700	124,800	139,000	4,500
Skipjack	179,400	145,400	122,400	167,000	7,200
Bigeye	23,000	27,500	23,800	30,600	700

Summaries of the estimated retained catches, by species and by flag of vessel, are shown in Table 2.

Catch-per-unit-of-effort statistics for purse seine vessels

No adjustments in the catch-per-unit-of-effort data are included for 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.

The measures of catch rate used in analyses 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 Class-6 vessels (vessels with fish-carrying capacities greater than 363 metric tons), and only data for these vessels are included in these measures of catch rate. There are now far fewer pole-and-line vessels than in previous years, so the data for these vessels are combined without regard to their fish-carrying capacities.

The estimated nominal catches per day of fishing for yellowfin, skipjack, and bigeye in the EPO during the first quarter of 2016 and comparative statistics for 2011-2015 were:

Region	Species	Gear	2016	2011-2015		
				Average	Minimum	Maximum
N of 5° N	Yellowfin	PS	11.8	16.1	14.5	17.7
S of 5° N			3.9	3.7	2.4	4.8
N of 5° N	Skipjack	PS	1.0	0.9	0.4	1.6
S of 5° N			18.5	13.0	10.2	14.7
EPO	Bigeye	PS	2.2	1.9	1.5	2.4
EPO	Yellowfin	LP	0.0	1.4	0.0	5.6
EPO	Skipjack	LP	0.0	1.4	0.0	5.0

Catch statistics for the longline fishery

The catches of bigeye by longline gear in the EPO are reported by flag states whose annual catches have exceeded 500 t (http://iattc.org/PDFFiles2/C-09-01-Tuna-conservation-2009-2011.pdf). Preliminary estimates of the catches reported for the first two quarters of 2016 are shown in Table 3.

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. 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, and Venezuela. The catches of yellowfin and skipjack were first sampled in 1954, bluefin in 1973, and bigeye in 1975.

Data for fish caught during the first quarter of 2011-2016 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 2016, and the second shows data for the combined strata for the first quarter of each year of the 2011-2016 period. Samples were obtained from 229 wells containing fish that were caught during the first quarter of 2016.

There are ten surface fisheries for yellowfin defined for stock assessments: four associated with floating objects, two with unassociated schools, three associated with dolphins, and one pole-and-line (Figure 1). The last fishery includes all 13 sampling areas. Of the 229 wells sampled that contained fish caught during the first quarter of 2016, 158 contained yellowfin. The estimated size compositions of these fish are shown in Figure 2a. The largest size yellowfin in the 100- to 140-cm range was taken in the Coastal and Southern dolphin fisheries, and to a lesser extent in the Northern dolphin fishery. Smaller size (<100 cm) yellowfin was taken in the Inshore floating-object fishery and the Northern and Southern unassociated fisheries and the Northern and Inshore dolphin fisheries. The majority of the smallest yellowfin was taken in the Southern unassociated fishery, while the greatest average size yellowfin (32.0 kg) was taken in the Southern dolphin fishery.

The estimated size compositions of the yellowfin caught by all fisheries combined during the first quarters of 2011-2016 are shown in Figure 2b. The average weight of yellowfin caught during the first quarter of 2016 (9.9 kg) was among the lowest yearly average weights of the period, and much less than the 15.1 kg average weight of 2015. The 2016 first quarter distribution of yellowfin sizes was fairly uniform between 50- and 140-cm, with the greatest number of fish at around 100 cm.

There are eight fisheries for skipjack defined for stock assessments: four associated with floating objects, two with unassociated schools, one associated with dolphins, and one pole-and-line (Figure 1). The last two fisheries include all 13 sampling areas. Of the 229 wells sampled that contained fish caught during the first quarter of 2016, 164 contained skipjack. The estimated size compositions of these fish are shown in Figure 3a. The majority of the skipjack was caught in the Inshore and Southern floating-object fisheries, and in the Southern unassociated fishery. Most of the smallest size skipjack in the 30- to 40-cm range was taken in the Southern floating-object fishery, with an average weight of 1.2 kg, while the largest size skipjack, in the 65- to 70-cm range, was taken in the Southern unassociated fishery, with an average weight of 2.7 kg.

The estimated size compositions of skipjack caught by all fisheries combined during the first quarter of 2011-2016 are shown in Figure 3b. The average weight of skipjack caught during the first quarter of 2016 (1.8 kg) was less than that of any in the previous five years (range 1.9- to 2.4-kg), with a more uniform size distribution than in any of the previous years.

There are seven surface fisheries for bigeye defined for stock assessments: four associated with floating objects, one with unassociated schools, one associated with dolphins, and one pole-and-line (Figure 1). The last three fisheries include all 13 sampling areas. Of the 229 wells sampled that contained fish caught during the first quarter of 2016, 41 contained bigeye. The estimated size compositions of these fish are shown in Figure 4a. All of the catch was taken in floating-object sets, primarily in the Southern area. Most of the bigeye was in the 35- to 80-cm range.

The estimated size compositions of bigeye caught by all fisheries combined during the first quarter of 2011-2016 are shown in Figure 4b. The average weight of bigeye caught during the first quarter of 2016 (4.2 kg) was less than that of any of the previous five periods (range 5.4- to 11.0-kg). The size distribution was fairly uniform, with most of the catch less than 85 cm in length.

The estimated retained purse-seine catch of bigeye less than 60 cm in length during the first quarter of 2016 was 2,400 t, or about 42 percent of the estimated total retained purse-seine catch of bigeye during that period. The corresponding amounts for 2011-2015 ranged from 1,600 to 4,900 t, or 10 to 36 percent respectively. These values may differ slightly from those given in previous Quarterly Reports due to changes in the estimation procedure.

BIOLOGY AND ECOSYSTEM PROGRAM

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 except for 1-16 April, 2, 3, 30, and 31 May, and 2-7, 28, and 30 June. Spawning occurred between 8:25 p.m. and 11:10 p.m. The number of eggs collected ranged from 3,000 to 1,090,000 per day. During the quarter the water temperatures in the tank ranged from 25.2 to 28.7°C.

At the end of the quarter there were five 53- to 56-kg, one 44-kg, and five 23- to 26-kg yellowfin in Tank 1. There were three 3- to 4-kg yellowfin in the 170,000-L reserve broodstock tank (Tank 2).

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, and hatching rate. The lengths of hatched larvae, duration of yolk-sac stage, weights of the eggs, yolk-sac larvae, and first-feeding larvae, and the lengths and selected morphometrics of these, were measured periodically.

Studies of snappers

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

During 1996-2009, the ARAP staff had conducted full life cycle research on spotted rose snappers (*Lutjanus guttatus*) in captivity. Efforts to rebuild the broodstock population of this species had been unsuccessful in recent years. During the second quarter of 2013, a major fishing effort was undertaken, and more than 100 spotted rose snappers were collected in local waters. At the end of June 2016, a small group of fish continued to be held in the broodstock snapper tank. These fish began spawning during 2015 (see IATTC Quarterly Report for July-September 2015) and have continued spawning sporadically throughout the first two quarters of 2016.

Visitors at the Achotines Laboratory

Mr. Jeff Tedmori, the Finance Administrator for Patagonia spent the period of 5-11 June 2016, at the Achotines Laboratory. (Patagonia is a company that specializes in outdoor clothing and gear.) Mr. Tedmori was participating in a program Patagolnia has for employees, allowing them to spend a period of time as an intern at suitable locations where environmental studies are conducted. His expenses were paid by Patagonia.

Mr. Marlon Román spent the period of 6-11 June 2016, at the Achotines Laboratory, where he worked with Ms. Massiel Delgado and members of the staff of the Achotines Laboratory, finalizing construction of nine biodegradable FADs and participating in their successful deployment. This project is funded by the European Union.

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). (The depth of the thermocline is a proxy for the depth of the upper edge of the oxygen-minimum zone, a thick layer of oxygen-poor water underlying the upper mixed layer. In locations where the thermocline is shallow, the habitat for tunas, especially yellowfin tuna, is vertically compressed near the surface of the ocean, where they are vulnerable to capture by surface gear.) 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.

During the third quarter of 2014, extensive areas of warm water were developing north of about 10°S (IATTC Quarterly Report for July-September 2014: Figure 5)—the early onset of the El Niño event that had been predicted by the U.S. National Weather Service (IATTC Quarterly Report for January-March 2014). During October, November, and December, however, the warm water was confined mostly to the area north of the equator and, in fact, a small area of cool water appeared well south of the equator and grew larger in November and December (IATTC Quarterly Report for October-December 2014: Figure 5). By January 2015 the area of warm water off Mexico had expanded to the southwest, combining with an area of warm water along the equator that persisted through June (IATTC Quarterly Report for April-June 2015: Figure 5). During the third quarter of 2015 the areas of warm water off Baja California and along the equator grew larger and warmer (IATTC Quarterly Report for July-September 2015: Figure 5). During the fourth quarter of 2015, the SSTs were above normal over much of the area north of 10°S, and off Peru, but nearly normal over most of the rest of the area south of the equator. The SSTs had been mostly below normal from October 2013 through March 2014, but during April 2014 through December 2015 they were virtually all above normal (Table 4).

According to the Climate Diagnostics Bulletin of the U.S. National Weather Service for March 2016, "Nearly all models predict further weakening of El Niño, with a transition to ENSO-neutral likely during late [northern] spring or early summer 2016 … Then, the chance of [anti-El Niño] increases during the late summer or early fall. The official forecast is consistent with the model forecasts, also supported by a historical tendency for [anti-El Niño] to follow strong El Niño events. A transition to ENSO-neutral is likely during late Northern Hemisphere spring or early summer 2016, with an increasing chance of [anti-El Niño] during the second half of the year."

BYCATCH PROGRAM AND INTERNATIONAL DOLPHIN CONSERVATION PROGRAM

Observer program

Coverage

The Agreement on the International Dolphin Conservation Program (AIDCP) requires 100-percent coverage by observers on trips by Class-6 purse seiners (vessels with fish-carrying capacities greater than 363 metric tons) that fish for tunas in the eastern Pacific Ocean (EPO). This mandate is carried out by the IDCP 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, and the Regional Observer Program (ROP) under the umbrella of the WCPFC, based on a Memorandum of Cooperation (MOC) signed by representatives of the IATTC and the WCPFC.

In addition, Resolution C-12-08 of the IATTC indicates that "Any vessel [regardless of size class] with one or more of its wells sealed to reduce its well volume recorded on the Regional Vessel Register shall be required to carry an observer from the International Dolphin Conservation Program (IDCP) on board." Furthermore, Resolution C-13-01 allows Class-4 purse-seine vessels (vessels with fish-carrying capacities of 182 to 272 metric tons) to make a single fishing trip of up to 30 days duration during the specified closure periods, provided that such vessel carries an observer of the IDCP On-Board Observer Program.

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).

During the second quarter of 2016 the observer programs of Colombia, the European Union, Mexico, Nicaragua, Panama, and Venezuela were to sample half, and that of Ecuador approximately one-third, of the trips by vessels of their respective fleets, while IATTC observers were to sample the remainder of those trips. Except as described in the next paragraph, the IATTC was 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 IDCP 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 IDCP On-Board Observer Program is not practical. In 2011, the IATTC and the WCPFC agreed on the MOC described above. As part of the implementation of the MOC, representatives of the two organizations put together a series of procedures to follow for the observers of the ROP under the umbrella of the WCPFC for tuna purse seiners, while observing fishing activity in the IATTC convention area. During the second quarter of 2016 one party to both regional fisheries management organizations, and to the AIDCP, requested that five cross-endorsed observers be allowed to be deployed on any trips of vessels planning to operate in both areas.

Observers from the IDCP On-Board Observer Program departed on 240 fishing trips aboard purse seiners covered by that program during the second quarter of 2016. Preliminary coverage data for these vessels during the quarter are shown in Table 5. In addition, there was one trip of a vessel registered in a nation party to the AIDCP that does not regularly fish in the EPO that was sighted fishing in the area of overlap between the IATTC and the WCPFC.

Although there is an agreement between the two tuna management organizations, there is no formal agreement with the AIDCP. This subject has been brought to the attention of the parties to the AIDCP and the IATTC.

Observer training

One observer training session was conducted by the IATTC staff in Manta, Ecuador, from 28 May to 8 June 2016. There were 17 participants, 7 from the national observer program of Ecuador and 10 from the international program of the IATTC.

Gear project

During the second quarter of 2016 the IATTC staff did not carry out ant dolphin safety-gear inspections and safety-panel alignment procedures for Class-6 purse seiners that participate in the fisheries for tunas associated with dolphins. However, members of the staff of the national observer program of Mexico, trained by the IATTC staff, conducted two such inspections.

Training and certification of fishing captains and crew members

The IATTC has conducted dolphin mortality reduction seminars for tuna fishermen since 1980. Article V of the AIDCP calls for the establishment, within the framework of the IATTC, of a system of technical training and certification of fishing captains. Under the system, the IATTC staff is responsible for maintaining a list of all captains qualified to fish for tunas associated with dolphins in the EPO. The names of the captains who meet the requirements are to be supplied to the International Review Panel for approval and circulation to the parties to the AIDCP.

One of the requirements for new captains are (1) attending a training seminar organized by the IATTC staff or by the pertinent national program, in coordination with the IATTC staff, The fishermen and others who attend the seminars are presented with certificates of attendance. During the second quarter of 2016 the IATTC staff did not conduct any such seminars.

PUBLICATIONS

Frommel, Andreas Y, Daniel Margulies, Jeanne B. Wexler, Maria S. Stein, Vernon P. Scholey, Jane E. Williamson, Don Bromhead, Simon Nicol, and Jon Havenhand. 2016. Ocean acidification has lethal and sub-lethal effects on larval development of yellowfin tuna, *Thunnus albacares*. Jour. Exper. Mar. Biol. Ecol., 482: 18-24.

Schaefer, Kurt M., and Daniel W. Fuller. 2016. Methodologies for investigating oceanodromous fish movements: archival and pop-up satellite archival tags. *In*: Morias, Pedro, and Fraçoise Daverat (editors). An Introduction to Fish Migration. CRC Press, Boca Raton, Florida, USA: 252-289.

Van Noord, Joel E., Robert J. Olson, Jessica V. Redfern, Leanne M. Duffy, and Ronald S. Kaufmann. 2016. Oceanographic influences on the diet of 3 surface-migrating myctophids in the eastern tropical Pacific Ocean. U.S. Nat. Mar. Fish. Serv., Fish. Bull., 114 (3): 274–287.

A special issue of Fisheries Research devoted to papers of growth of fish presented at a CAPAM workshop held in La Jolla, California, USA, on 3-7 November 2014, has been published. The following papers co-authored by IATTC staff members are in that special issue:

Maunder, Mark N., Paul R. Crone, Andre E. Punt, Juan I. Valero, and Brice X Semmens. 2016. Growth: theory, estimation, and application in fishery stock assessment models. Fisheries Research, 180: 1-3.

Minte-Vera, Carolina V., Mark N. Maunder, John M. Casselman, and Steven E. Campana. 2016. Growth functions that incorporate the cost of reproduction. Fisheries Research, 180: 31-44.

Zhu, Jiangfeng, Mark N. Maunder, and Alexandre M. Aires-da-Silva. 2016. Estimation of growth within Stock Synthesis models: Management implications when using length-composition data. Fisheries Research, 180: 87-91.

Francis, R.I.C. Chris, Alexandre M. Aires-da-Silva, Mark N. Maunder, Kurt M. Schaefer, and Daniel W. Fuller. 2016. Estimating fish growth for stock assessments using both age–length and tagging-increment data. Fisheries Research, 180: 113-118.

Piner, Kevin R., Hui-Hua Lee, and Mark N. Maunder. 2016. Evaluation of using random-at-length observations and an equilibrium approximation of the population age structure in fitting the von Bertalanffy growth function. Fisheries Research, 180: 128-137.

ADMINISTRATION

Mr. Lesly Rodriguez, an IATTC employee since 1 September 1979, retired on 30 April 2016. Before Mr. Rodriguez began working for the IATTC, he made his first trip as an observer aboard the *Esperanza*, a purse seiner registered in Nicaragua, from 27 March to 11 July 1979. After the trip, Dr. Robin Allen, who at the time was in charge of what was then called the Tuna-Dolphin Program, offered him a job in La Jolla, which Mr. Rodriguez accepted. After another trip as an observer aboard the Costa Rican purse seiner *Orosi* from 24 June to 24 September 1980, he became an observer's trainer in various countries in Latin America—Ecuador, Mexico, Panama, and Venezuela. In Ensenada, he trained Messrs. Ernesto Altamirano and Enrique Ureña, currently members of the IATTC staff.

During his tenure as an IATTC staff member in La Jolla, Mr. Rodriguez had different assignments related to the Tuna-Dolphin Program and the International Dolphin Conservation Program, which succeeded it, mainly editing data collected by IATTC observers aboard tuna vessels. He had considerable interaction with field office staff members, issuing trip numbers for vessels sampled by observers, collecting and filing their weekly reports, and updating the data bases with information provided in those reports, *e.g*. departure and arrival dates and other required information, and providing assistance with any other tasks required by the Program staff, later called the International Dolphin Conservation Program and Bycatch Program, and the rest of the staff.

Mr. Rodriguez made one more trip on a purse seiner in 1993—that time aboard the Vanuatu-flag purse seiner *Marinero*, from 14 August to 2 October 1993.

Mr. Rodriguez was a highly-valued member of the IATTC staff, performing his duties cheerfully and efficiently. Everyone will miss him.

Mr. Rodriguez plans to spend more time with his family, doing some traveling, visiting family members and friends, and “taking life easy.” Everyone wishes him many happy years of retirement.

VISITING STUDENT

Mr. Christoffer Moesgaard Albertsen, a Ph.D. candidate at the National Institute of Aquatic Resources, Technical University of Denmark (“DTU Aqua”), who had begun a 6-month visit at the IATTC headquarters in La Jolla, California, USA, on 6 January 2016, completed his work on 30 June 2016 and returned to Denmark. His work was in applied statistics and fisheries, specifically with state-space models applied to two areas, tracking of marine animals, and stock-assessment models. He was working with Dr. Mark N. Maunder on a geostatistical model, using the R-package Template Model Builder (TMB).

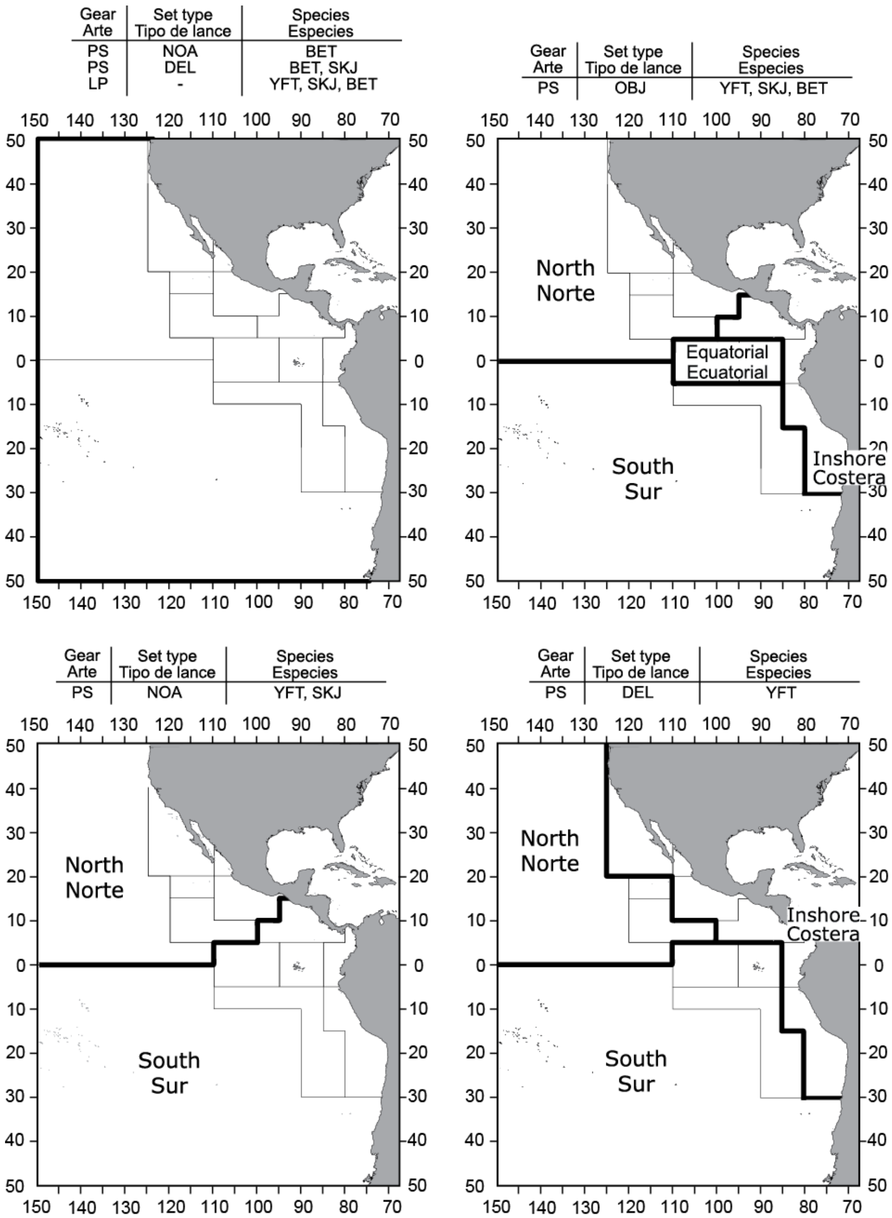

FIGURE 1. Spatial extents of the fisheries defined by the IATTC staff for stock assessment of yellowfin, skipjack, and bigeye in the EPO. The thin lines indicate the boundaries of the 13 length-frequency sampling areas, and the bold lines the boundaries of the fisheries. Gear: PS = purse seine, LP = 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, y patudo 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 = peces no asociados, DEL = delfín; OBJ = objeto flotante; Especies: YFT = aleta amarilla, SKJ = barrilete, BET = patudo.

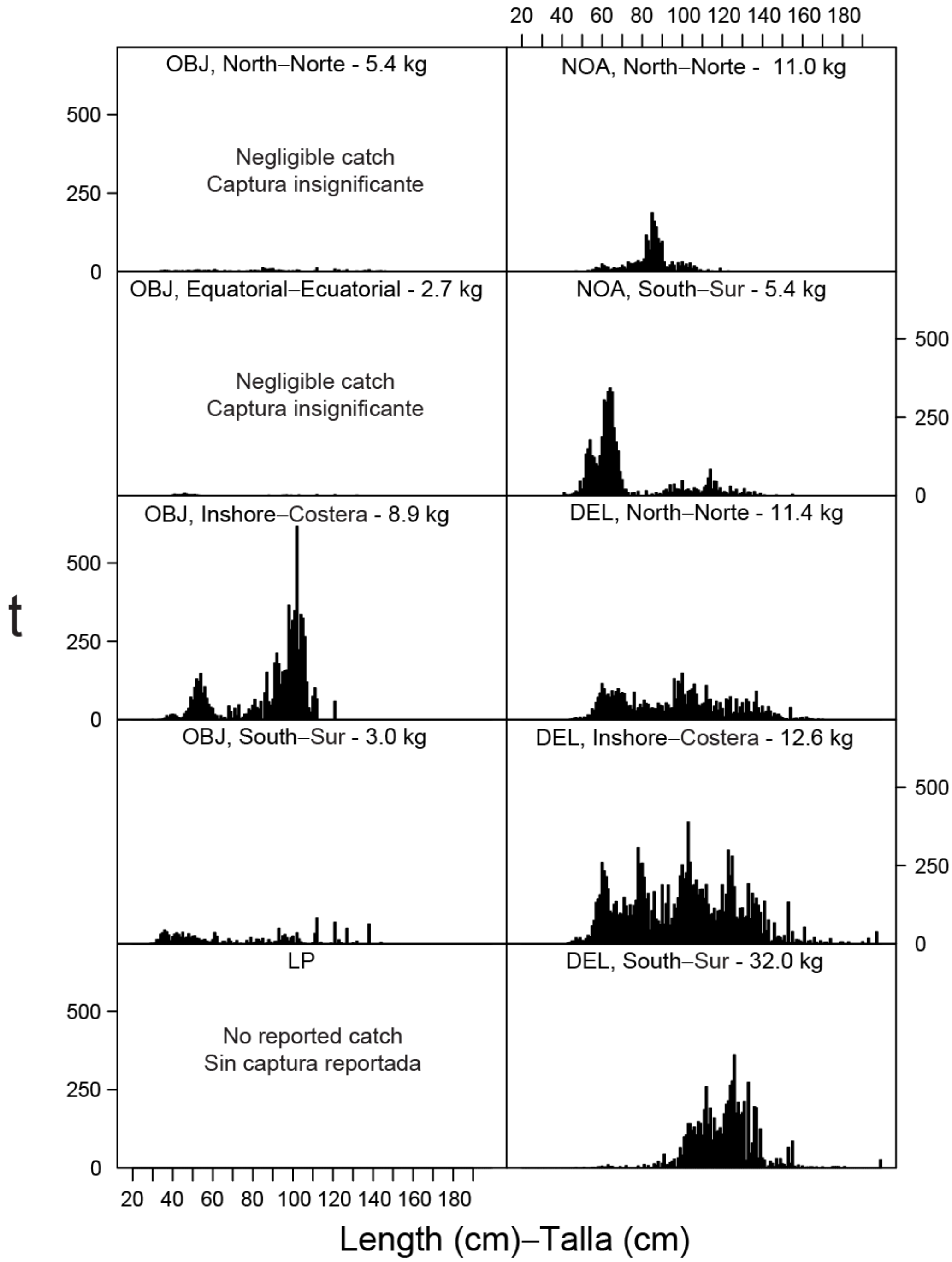

FIGURE 2a. Estimated size compositions of the yellowfin caught in each fishery of the EPO during the first quarter of 2016. The average weights of the fish in the samples are given at the tops of the panels. OBJ = floating object; LP = pole and line; NOA = unassociated; DEL = dolphin; t = metric tons.

FIGURA 2a. Composición por tallas estimada para el aleta amarilla capturado en cada pesquería del OPO durante el primero trimestre de 2016. En cada recuadro se detalla el peso promedio de los peces en las muestras. OBJ = objeto flotante; LP = caña; NOA = peces no asociados; DEL = delfín; t = toneladas métricas.

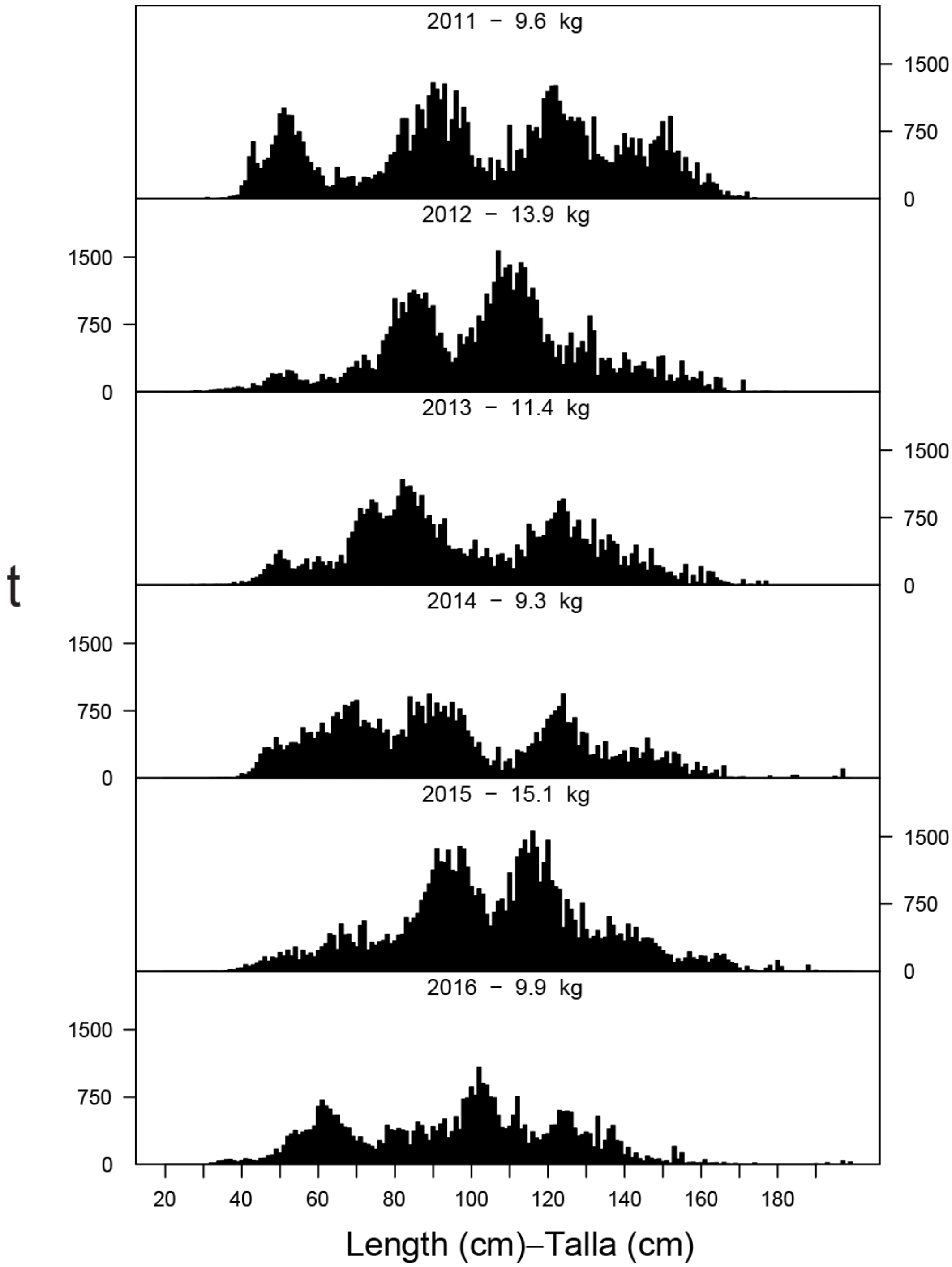

FIGURE 2b. Estimated size compositions of the yellowfin caught in the EPO during the first quarter of 2011-2016. The average weights of the fish in the samples are given at the tops of the panels. t = metric tons.

FIGURA 2b. Composición por tallas estimada para el aleta amarilla capturado en el OPO en el cuarto trimestre de 2011-2016. En cada recuadro se detalla el peso promedio de los peces en las muestras; t = toneladas métricas.

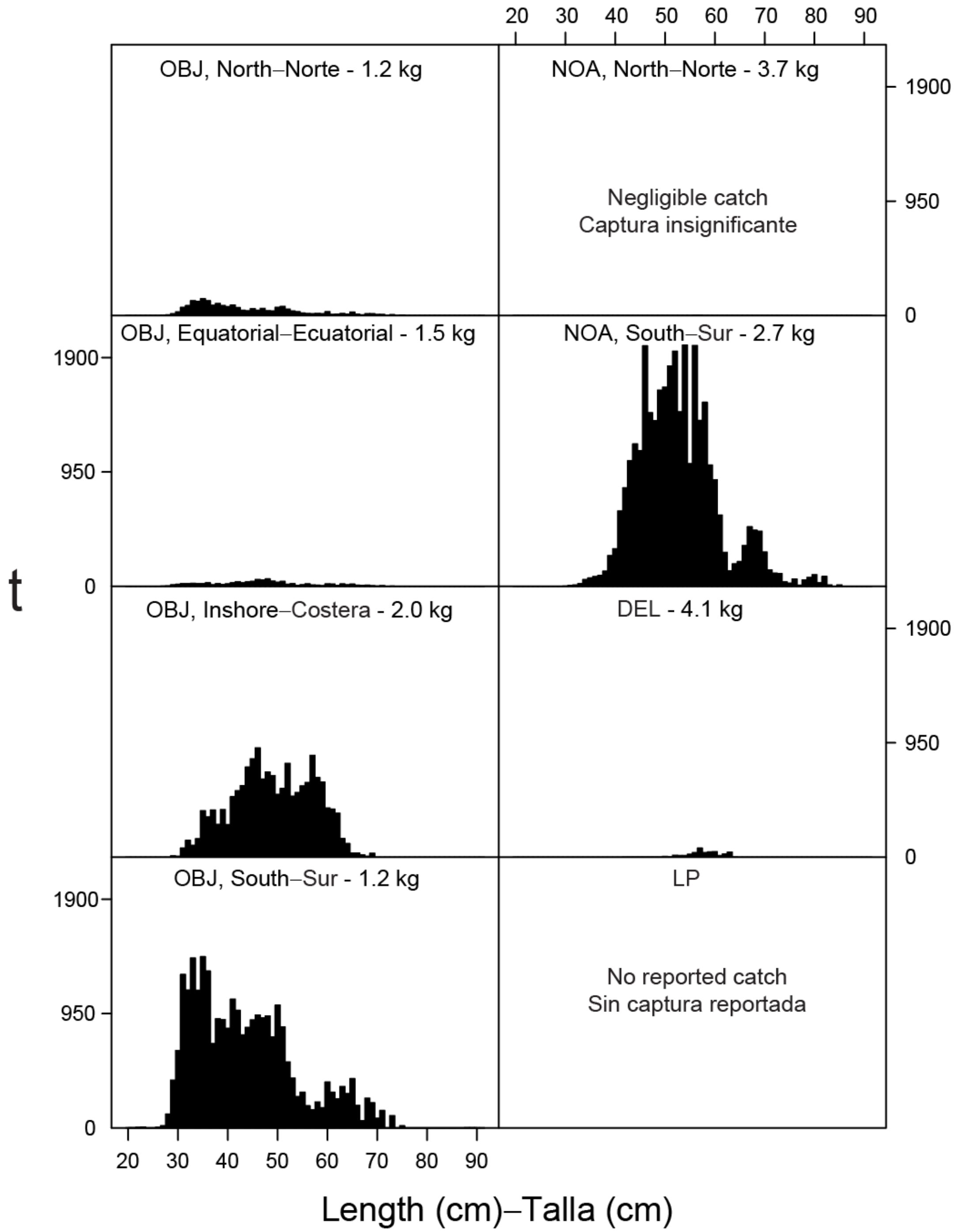

FIGURE 3a. Estimated size compositions of the skipjack caught in each fishery of the EPO during the first quarter of 2016. The average weights of the fish in the samples are given at the tops of the panels. OBJ = floating object; LP = pole and line; NOA = unassociated; DEL = dolphin; t = metric tons.

FIGURA 3a. Composición por tallas estimada para el barrilete capturado en cada pesquería del OPO durante el primero trimestre de 2016. En cada recuadro se detalla el peso promedio de los peces en las muestras. OBJ = objeto flotante; LP = caña; NOA = peces no asociados; DEL = delfín; t = toneladas métricas.

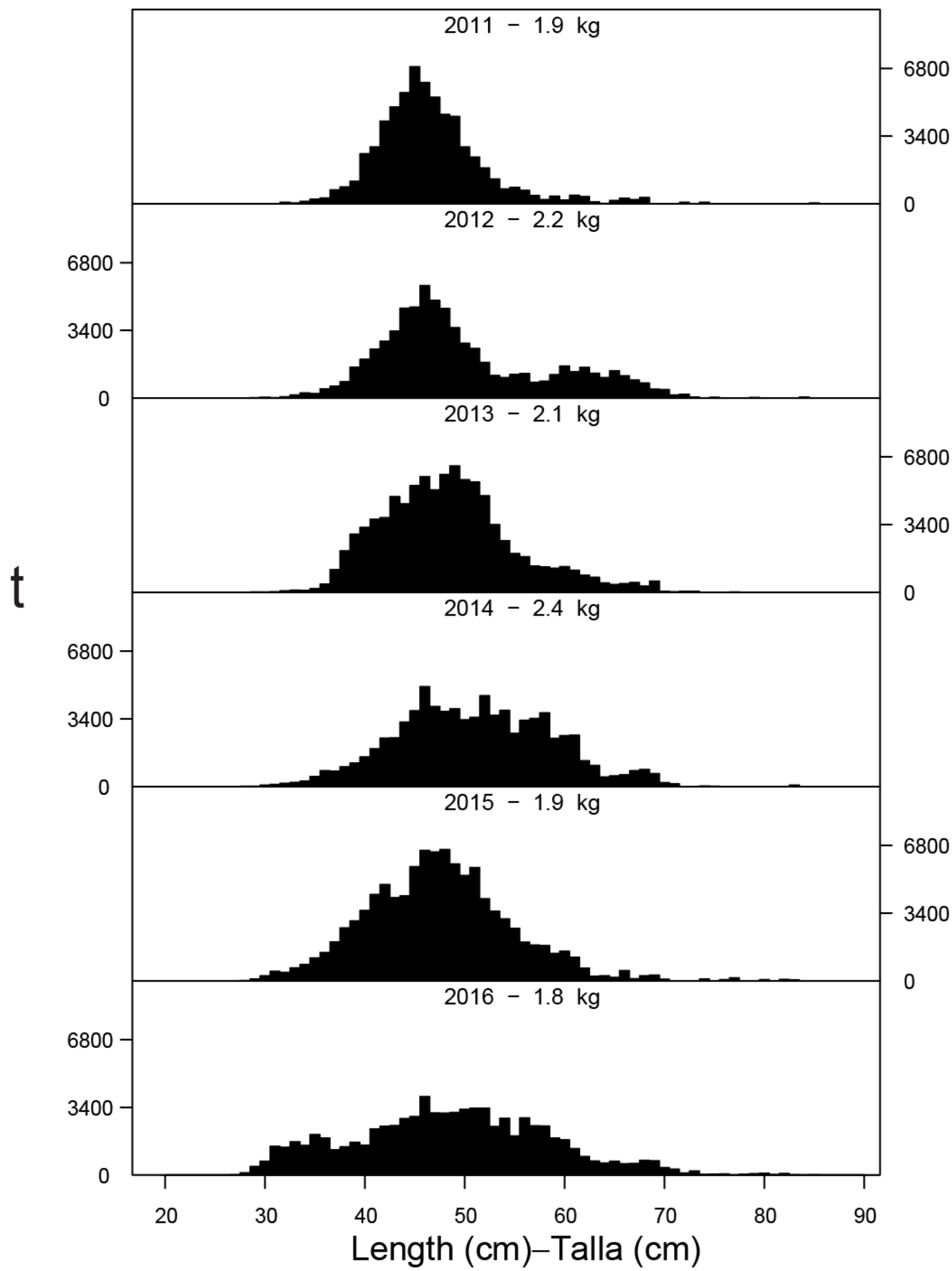

FIGURE 3b. Estimated size compositions of the skipjack caught in the EPO during the first quarter of 2011-2016. The average weights of the fish in the samples are given at the tops of the panels. t = metric tons.
FIGURA 3b. Composición por tallas estimada para el barrilete capturado en el OPO en el primero trimestre de 2011-2016 En cada recuadro se detalla el peso promedio de los peces en las muestras. t = toneladas métricas.

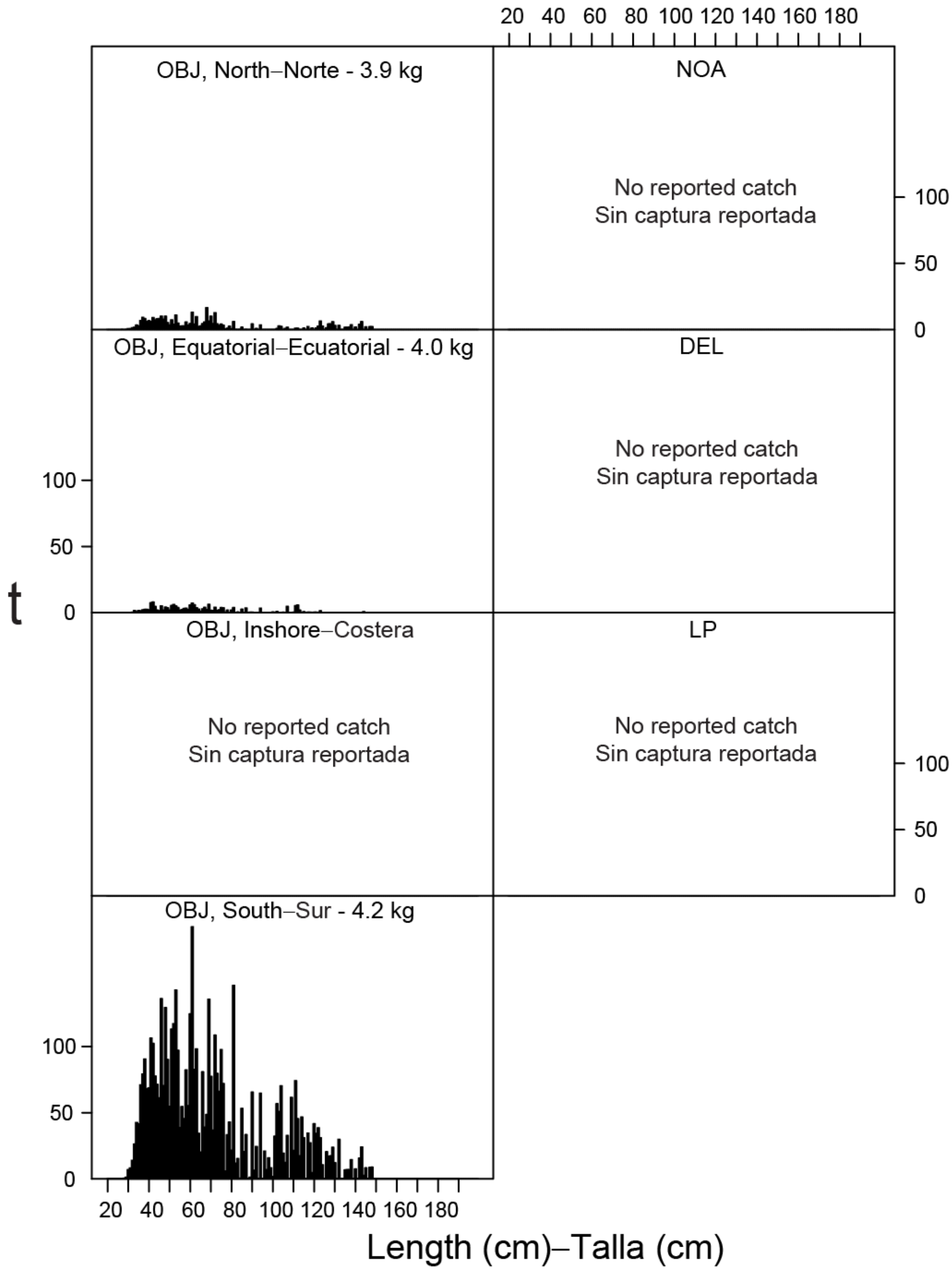

FIGURE 4a. Estimated size compositions of the bigeye caught in each fishery of the EPO during the first quarter of 2016. The average weights of the fish in the samples are given at the tops of the panels. OBJ = floating object; LP = pole and line; NOA = unassociated; DEL = dolphin; t = metric tons.

FIGURA 4a. Composición por tallas estimada para el patudo capturado en cada pesquería del OPO durante el primero trimestre de 2016. En cada recuadro se detalla el peso promedio de los peces en las muestras. OBJ = objeto flotante; LP = caña; NOA = peces no asociados; DEL = delfín; t = toneladas métricas.

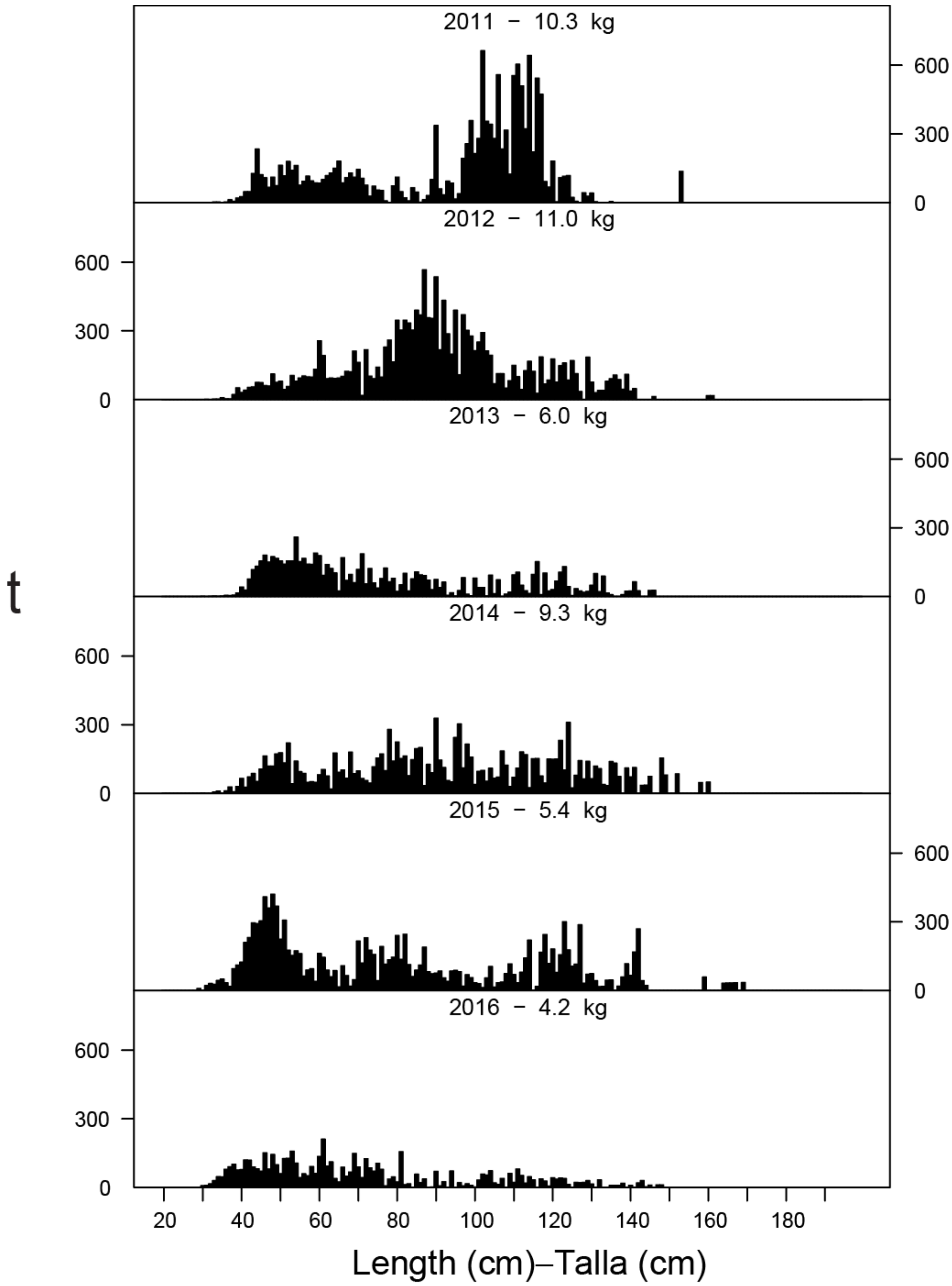

FIGURE 4b. Estimated size compositions of the bigeye caught in the EPO during the first quarter of 2011-2016. The average weights of the fish in the samples are given at the tops of the panels. t = metric tons.

FIGURA 4b. Composición por tallas estimada para el patudo capturado en el OPO en el primero trimestre de 2011-2016. En cada recuadro se detalla el peso promedio de los peces en las muestras; t = toneladas métricas.

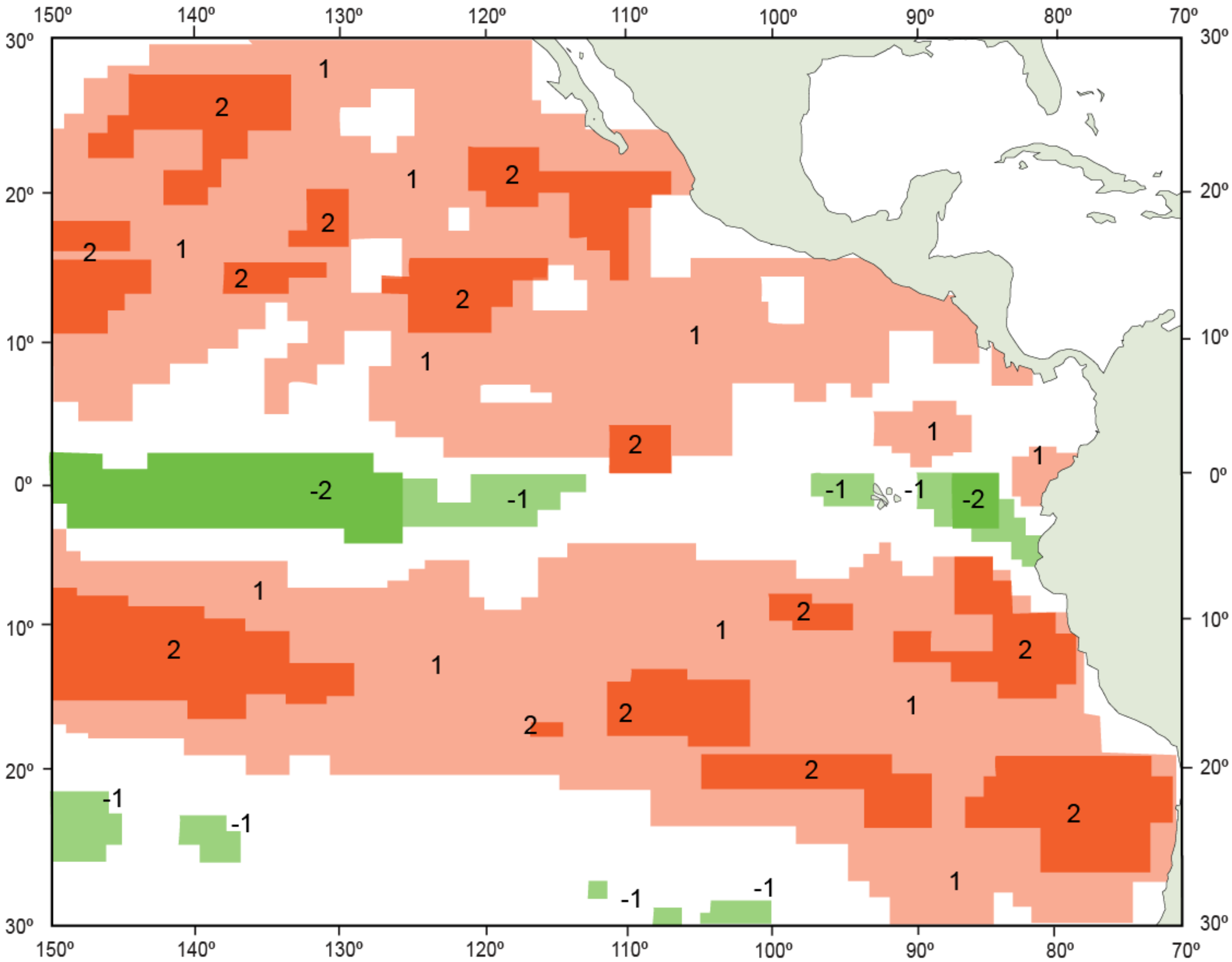

FIGURE 5. Sea-surface temperature (SST) anomalies (departures from long-term normals) for June 2016, based on data from fishing boats and other types of commercial vessels.
FIGURA 5. Anomalías (variaciones de los niveles normales a largo plazo) de la temperatura superficial del mar (TSM) en junio de 2016, basadas en datos tomados por barcos pesqueros y otros buques comerciales.

TABLE 1. Estimates of the numbers and capacities (m^3) of purse seiners and pole-and-line vessels operating in the EPO in 2016 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 del número de buques cerqueros y cañeros que pescan en el OPO en 2016, y de la capacidad de acarreo (m^3) de los mismos 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		
Colombia	PS	4	10	-	14	14,860
Ecuador	PS	74	25	13	112	91,651
Unión Europea (España)—European Union (Spain)	PS	-	-	2	2	4,120
Guatemala	PS	-	1	-	1	1,475
México	PS	10	38	1	49	60,146
	LP	1	-	-	1	125
Nicaragua	PS	-	5	1	6	8,478
Panamá	PS	2	8	4	14	19,794
Perú	PS	8	-	-	8	3,618
El Salvador	PS	-	-	2	2	4,473
USA—EE.UU.	PS	9	7	8	24	27,461
Venezuela	PS	-	14	2	16	23,092
All flags—	PS	107	108	33	248	
Todas banderas	LP	1	-	-	1	
	PS + LP	108	108	33	249	
				Capacity—Capacidad		
All flags—	PS	48,253	143,721	67,194	259,168	
Todas banderas	LP	125	-	-	125	
	PS + LP	48,378	143,721	67,194	259,293	

TABLE 2. Estimates of the retained catches of tunas in the EPO, from 1 January through 3 July 2016, by species and vessel flag, in metric tons.
TABLA 2. Estimaciones preliminares de las capturas retenidas de atunes en el OPO del 1 de enero al 3 de julio 2016, 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	26,718	104,834	14,250	-	2,225	-	128	280	148,435	43.7
México	54,132	5,156	92	2,904	-	-	2,712	-	64,996	19.1
Nicaragua	4,967	499	189	-	-	-	-	-	5,655	1.7
Panamá	14,494	16,648	3,263	-	30	-	-	-	34,435	10.1
United States – Estados Unidos	1,293	24,577	824	4	201	2	-	-	26,901	7.9
Venezuela	11,623	3,734	311	-	-	-	6	-	15,674	4.6
Other—Otros[2]	15,336	24,000	4,050	-	129	-	1	-	43,516	12.9
Total	128,563	179,448	22,979	2,908	2,585	2	2,847	280	339,612	

1 Includes other tunas, sharks, and miscellaneous fishes
1 Incluye otros túnidos, tiburones, y peces diversos
2 Includes Colombia, El Salvador, European Union (Spain), Guatemala and Peru; this category is used to avoid revealing the operations of individual vessels or companies.
2 Incluye Colombia, El Salvador, Guatemala, Perú, y Unión Europea (España); se usa esta categoría para no revelar información sobre faenas de buques o empresas individuales.

TABLE 3. Preliminary estimates of the catches of bigeye tuna, in metric tons, in the eastern Pacific Ocean during the first and second quarters of 2016 by longline vessels more than 24 meters in overall length.

TABLA 3. Estimaciones preliminares de las capturas de atún patudo, en toneladas métricas, en el Océano Pacífico oriental durante el primero y segundo trimestres de 2016 por buques palangreros de más de 24 metros en eslora total.

Flag	First quarter	Month			Second quarter	Total to date
		4	5	6		
Bandera	**Primer trimestre**	**Mes**			**Segundo trimestre**	**Total al fecha**
		4	**5**	**6**		
China	1,779	401	-	-	401	2,180
Republic of Korea—República de Corea	2,238	390	253	-	643	2,881
Japan—Japón	3,457	869	669	-	1,538	4,995
Chinese Taipei—Taipei Chino	1,311	138	-	-	138	1,449
USA—EE.UU.	-	-	-	-	-	-
Vanuatu	-	-	-	-	-	-
Total	8,785	1,798	922	-	2,720	11,505

TABLE 4. Oceanographic and meteorological data for the Pacific Ocean, April 2015-March 2016. The values in parentheses are anomalies. SST = sea-surface temperature; SOI = Southern Oscillation Index; SOI* and NOI* are defined in the text.
TABLA 4. Datos oceanográficos y meteorológicos del Océano Pacífico, abril 2015-marzo 2016. 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)	24.5 (2.9)	22.9 (2.3)	22.9 (2.6)	23.3 (2.5)	23.7 (2.1)	25.0 (2.2)
Area 2 (5°N-5°S, 90°-150°W	27.8 (2.2)	27.3 (2.3)	27.5 (2.6)	27.6 (2.7)	27.9 (2.9)	28.0 (2.9)
Area 3 (5°N-5°S, 120°-170°W)	28.8 (1.6)	28.9 (2.1)	29.0 (2.3)	29.2 (2.5)	29.6 (3.0)	29.4 (2.8)
Area 4 (5°N-5°S, 150W°-160°E)	29.8 (1.0))	29.7 (1.0)	29.7 (1.0)	29.8 (1.1)	30.3 (1.7)	30.1 (1,6)
Thermocline depth—Profundidad de la termoclina, 0°-80°W	50	40	30	40	45	30
Thermocline depth—Profundidad de la termoclina, 0°-110°W	90	100	110	100	110	95
Thermocline depth—Profundidad de la termoclina, 0°-150°W	150	150	145	155	130	125
Thermocline depth—Profundidad de la termoclina, 0°-180°	160	160	160	120	105	95
SOI—IOS	-1.1	-1.4	-1.6	-1.7	-0.5	-0.6
SOI*—IOS*	-1.61	-5.46	-5.42	-4.87	1.49	-1.81
NOI*—ION*	-4.05	-3.22	-2.71	-4.08	2.09	1.55

TABLE 4. (continued)
TABLA 4. (continuación)

Month—Mes	**1**	**2**	**3**	**4**	**5**	**6**
SST—TSM (°C)						
Area 1 (0°-10°S, 80°-90°W)	25.9 (1.4)	26.8 (0.7)	27.6 (0.9)	25.8 (0.2)	24.6 (0.3)	23.2 (0.3)
Area 2 (5°N-5°S, 90°-150°W	28.2 (2.6)	28.4 (2.0)	28.7 (1.6)	28.3 (0.8)	27.1 (0.0)	26.3 (-0.1)
Area 3 (5°N-5°S, 120°-170°W)	29.2 (2.6)	29.1 (2.4)	28.9 (1.7)	28.9 (1.1)	28.2 (1.3)	27.5 (-0.1)
Area 4 (5°N-5°S, 150W°-160°E)	29.7 (1.4)	29.6 (1.5)	29.5 (1.3)	29.4 (0.9)	29.4 (0,6)	29.4 (0.5)
Thermocline depth—Profundidad de la termoclina, 0°-80°W	40	30	25	25	20	20
Thermocline depth—Profundidad de la termoclina, 0°-110°W	95	85	40	25	25	30
Thermocline depth—Profundidad de la termoclina, 0°-150°W	150	120	105	100	100	105
Thermocline depth—Profundidad de la termoclina, 0°-180°	115	80	75	130	140	150
SOI—IOS	-2.2	-2.0	-0.1	-1.2	0.4	0.6
SOI*—IOS*	-6.59	-2.30	-1.53			
NOI*—ION*	-6.94	0.82	-2.06	-1.14	O,27	1.56

TABLE 5. Preliminary data on the sampling coverage of trips of tuna purse seine vessels deployed by the observer programs of the IATTC, Colombia, Ecuador, the European Union, Mexico, Nicaragua, Panama, Venezuela, and under the MOC described above, departing during the second quarter of 2016. The numbers in parentheses indicate cumulative totals for the year.
TABLA 5. Datos preliminares de la cobertura de muestreo de viajes de buques atuneros de cerco asignados por los programas de observadores de la CIAT, Colombia, Ecuador, México, Nicaragua, Panamá, la Unión Europea, Venezuela y bajo el MDC descrito arriba, durante el segundo trimestre de 2016. Los números entre paréntesis indican los totales acumulados para el año.

Flag	Trips		Class-6–Observed by program								Percentage observed	
Bandera	Viajes		Clase-6–Observado por programa								Porcentaje observado	
			IATTC CIAT		National Nacional		WCPFC		Not obs. No obs.			
Colombia	11	(22)	5	(10)	6	(12)					100.0	(100)
Ecuador	103	(219)	65	(144)	38	(75)					100.0	(100)
El Salvador	2	(6)	2	(6)							100.0	(100)
EU (Spain)—UE (España)	3	(6)	1	(3)	2	(3)					100.0	(100)
Guatemala	1	(2)	1	(2)							100.0	(100)
México	60	(137)	33	(67)	27	(70)					100.0	(100)
Nicaragua	8	(12)	3	(6)	5	(6)					100.0	(100)
Panamá	15	(40)	9	(20)	6	(20)					100.0	(100)
Perú	8	(18)	8	(18)							100.0	(100)
U.S.A.—E.U.A.	16	(34)	10	(27)			5	(5)	1	(2)	93.8	(94)
Venezuela	12	(25)	3	(12)	9	(13)					100.0	(100)
Total	239	(521)	140	(315)	93	(199)	5	(5)	1	(2)	99.6	(99.6)
					Class-5 - Clase							
Colombia	1	(3)	0	(1)	1	(2)					-	-
Total	1	(3)	0	(1)	1	(2)					-	-