# BILLFISH CATCH IN THE VENEZUELAN ARTISANAL OFF-SHORE PELAGIC LONGLINE FISHERY: PAST AND PRESENT (1986-2013)

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*SUMMARY*

*The Venezuelan artisanal off-shore (VAOS) pelagic longline fishery is a medium and long range fishery that operates within the Venezuelan EEZ and that of neighboring Caribbean island States and along the Guiana's shelf from Venezuela to French Guiana. The VAOS pelagic longline fishery usually operates with pelagic longlines and handlines, that uses live bait to commonly target pelagic species such as dolphinfish (Coryphaena hippurus), billfish, tunas, sharks, and coastal scombrids like king and brazilian mackerel (Scomberomorus cavalla, S. brasiliensis), and wahoo (Acantocybium solandri). The VAOS pelagic longline fishery has been known to target billfish species since the late 1980s, in this document statistical data from various sources, official statistics, publications, grey literature, expert opinion, and several ICCAT monitoring projects for data improvement in Venezuela were used to reconstruct the species-specific billfish catch for the period of 1986-2013.*

*RÉSUMÉ*

*La pêcherie artisanale palangrière pélagique du Venezuela opérant en haute mer est une pêcherie à moyenne et longue portée qui est active dans la ZEE vénézuélienne et à proximité des États des îles des Caraïbes et le long du plateau de la Guyane du Venezuela à la Guyane française. Cette pêcherie opère généralement à la palangre pélagique et à la ligne à main et utilise des appâts vivants afin de cibler des espèces pélagiques telles que la coryphène commune (*Coryphaena hippurus*), les istiophoridés, les thonidés, les requins et les scombridés côtiers tels que le thazard barré et la sardinelle de Brésil (*Scomberomorus cavalla, S. brasiliensis*) et le thazard-bâtard (*Acantocybium solandri*). Il est notoire que cette pêcherie cible les espèces d'istiophoridés depuis la fin des années 80. Ce document utilise des données statistiques issues de plusieurs sources (statistiques officielles, publications, littérature grise, opinion d'expert et plusieurs projets de suivi de l'ICCAT destinés à l'amélioration des données) au Venezuela afin de reconstruire la capture des istiophoridés spécifique aux espèces pour la période 1986-2013.*

*RESUMEN*

*La pesquería de palangre pelágico artesanal de alta mar de Venezuela (VAOS) es una pesquería de distribución media a larga que opera dentro de la ZEE de Venezuela y en los vecinos Estados insulares caribeños, así como a lo largo de la plataforma de Guyana, que se extiende desde Venezuela hasta la Guyana francesa. La pesquería de palangre pelágico VAOS suele operar con liñas de mano y palangre pelágico, y utiliza cebo vivo para dirigirse a especies pelágicas como dorado (*Coryphaena hippurus*), istiofóridos, túnidos, tiburones y escómbridos costeros como carita lucio (*Scomberomorus cavalla*), serra (*Scomberomorus brasiliensis*) y peto (*Acantocybium solandri*). Se sabe que la pesquería de palangre pelágico VAOS se ha dirigido a los istiofóridos desde finales de los ochenta, y en este documento se utilizaron datos estadísticos de varias fuentes, como estadísticas oficiales, publicaciones, documentación gris (no publicada oficialmente), opinión de expertos y varios proyectos de seguimiento de ICCAT para mejorar los datos en Venezuela, para reconstruir la captura de istiofóridos desglosada por especies para el periodo 1986-2013.*

*KEYWORDS*

*Artisanal fishery, Catch statistics, Billfish, Pelagic longline, Caribbean Sea, Venezuela*

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## Introduction

The small scale artisanal fleet that targets tuna and tuna-like species formerly known as 'Flota Artesanal de Media-Altura y Altura' is now referred to as 'Flota Artesanal Costa-Afuera' (*i.e*., Artisanal Off-shore Fleet) by the National Fishery Agency (INSOPESCA). The Venezuelan Artisanal Off-Shore (VAOS) fleet operates on the same fishing areas as the Venezuelan industrial tuna fleets (PS, BB, and LL) in the Caribbean Sea and adjacent Atlantic waters. The VAOS fleet operating with pelagic longlines is formed by vessels around 15 m in length, targeting DOL, BIL, SHK and TUNas (Marcano *et al*., 1994, 1995).

Verbal accounts indicate that the VAOS pelagic longline fishery started in Margarita Island in the mid to late 1980's, as a result of the decreasing trend in the snapper-grouper catches, and the ease of catching large pelagic fishes with longline *vs* the difficulties in the snapper-grouper fishery. Initially, the VAOS billfish target fishery started operations from east to west of the Caribbean Sea along the Venezuela off-shore Islands, and as a result of the operations Margartia I. vessels started to settle along the Venezuelan coasts in ports where the price of billfish was higher. The VAOS fleet consists of approximately 1000 vessels (Mendoza *et al*., 2003), on average the eastern states of Nva Esparta and Sucre account to about 75% of the VAOS fleet, the rest is spread along the Venezuelan coast. However, the numbers of vessels in the VAOS fleet operating regularly with pelagic longline may be around 300, but no official statistics are available.

Recognizing the importance of the artisanal fisheries in Venezuela, and that a considerable proportion of the billfish catch taken from Venezuelan vessels come from artisanal fisheries, the estimation of the species-specific billfish catch from the VAOS fishery operating with pelagic longlines was reconstructed from various sources, official statistics, publications, grey literature, expert opinion, and several ICCAT monitoring projects for data improvement in Venezuela for the period of 1986-2013.

## Methods

### *Data sources*

The national agency responsible for collecting fishery statistic data in Venezuela is the Instituto Socialista de la Pesca y Acuicultura (INSOPESCA), while the official fisheries research conducted by the Instituto Nacional de Investigaciones Agropecuarias (INIA) contributes to provide catch estimates of species or taxonomic group from on-site sampling programs to enhance and correct INSOPESCA's fishery statistics. Over the years, billfish species have been included in the national statistics for artisanal fisheries as '*Agujas varias*' and/or '*palagar*'; where '*palagar*' is the most commonly used name to report and commercialize almost all billfish species, with the exception of blue marlin which is commonly referred to as '*aguja*'. However, the term '*aguja*' can be used for large blue/white marlins, thus it was considered unreliable to separate '*aguja*' from '*palagar*', therefore any statistical information available under either name was recorded as billfish unclassified that were to be separated into species later on (*see next section*). Data for artisanal marine fisheries are collected by the regional offices of INSOPESCA present in 11 coastal states (from east to west: Delta Amacuro, Monagas, Sucre, Nueva Esparta, Anzoátegui, Miranda, Vargas, Aragua, Carabobo, Falcón and Zulia) (SARPA, 1996). The data on '*Agujas varias*' and/or '*palagar*'collected by the national fishery agency for marine fisheries available in digital form, aggregated by year and state, was revised and analyzed for the period 1986-2011. Additionally, digital data by species and year was available from two of the most important States landing billfishes (*i.e.*, Nueva Esparta and Sucre). In Nueva Esparta (Margarita Island) catch estimates by species for the period 1986-2004 were recorded initially (1986-1992) by ICCAT's Enhanced Program for Billfish Research (EPBR) in Venezuela (Marcano *et al*., 1994) and continued by INIA (former FONAIAP) scientists in Margarita I. from 1992 to 2004 (Marcano *et al*., 1995; Arocha *et al*., 2006); for 2006 and 2007, billfish catch estimates were published in a study on artisanal fisheries in Nueva Esparta (Marval and Cervigón, 2009); and for 2012 and 2013, billfish catch estimates were available from ICCAT's JDMIP project in Venezuela. In Sucre, enhanced catch estimates of billfish species recorded by the regional offices of INSOPESCA were available from 2006 to 2013.

***Disaggregation of the billfish catch***

The aggregated billfish catch data from the artisanal catch statistics was separated into species using species specific proportion in weight by year (1986-2013) obtained from a couple of sources; 1, ICCAT's EPBR and FONAIAP/INIA port sampling of the artisanal longline fishery from Margarita Island; 2, ICCAT's JDMIP at-sea sampling program of the artisanal longline fishery off Margarita Island and Morro Pto. Santo, Sucre (Arocha *et al*., 2015). Noting that the proportion of billfish from the catch recorded by the JDMIP at-sea sampling program were in numbers of fish, weight estimates were used to convert numbers of fish into average dressed weight (*see* **Table 3**).

***Spatial distribution of fishing effort***

Presently, the VAOS pelagic longline fishery fishes within the Venezuelan EEZ and that of neighboring Caribbean island States and along the Guiana's shelf from Venezuela to French Guiana (**Figure 1**). The fishing area of the VAOS LL fishery has expanded over the years within the current fishing areas. In order to analyze the evolution of the expansion, the fishing effort in number of hooks in 1° by 1° square bins was analyzed from annual maps showing the spatial distribution of the fishing effort. The spatial data of the fishing effort for the period 1992-2003 was obtained from the FONAIAP/INIA port sampling program of the artisanal longline fishery from Margarita Island and interviews with Captains and crews. The spatial data of the fishing effort from August 2011 to March 2014 was obtained from at-sea and port sampling programs of the VAOS pelagic longline fishery off Margarita Island and Morro Pto. Santo, Sucre (ICCAT's JDMIP project in Venezuela).

**Results**

***Spatial distribution of fishing effort***

The spatial distribution of the fishing effort during the 1990's was concentrated in the Caribbean Sea (**Figure 2a**); the majority of that concentration was between 62° and 66° W, which included the area around Venezuela's eastern off-shore islands (*i.e*., La Orchila, La Tortuga, La Blanquilla, Los Testigos). On different years, fishing effort extended towards the west, close to the Island of Bonaire, and in the east, around Grenada and the Grenadines. After 2000 (**Figure 2b**), the spatial expansion of the fishing effort begins to appear in the Atlantic, SE of Trinidad, and becomes more apparent in 2002 and 2003 when the time series ends. The time series from the at-sea sampling program of the VAOS pelagic longline fishery off Margarita Island and Morro Pto. Santo, Sucre for 2011-2014, which is represented from 91 observed trips, show an apparent shift in the fishing effort towards the Atlantic. The low fishing effort shown in 2011 and 2014 is because it represents a fraction of the fishing effort during those years (last 5 months in 2011 and first 3 months of 2014), but the trend is still evident. The trend is further confirmed when the at-sea and port sampling fishing effort data from ICCAT's JDMIP project in Venezuela are combined to represent the trend of the fishing effort of the VAOS fishery (**Figure 3**). The fishing effort recorded from port sampling interviews is represented in 5° by 5° square bins as color coded and the at-sea sampling fishing effort is represented by the striped proportional circles in 1° by 1° square bins. For the years that were fully sampled (2012 and 2013), it became evident that the VAOS fishery with pelagic longline gear were operating in the southeastern Caribbean, and off the Guiana's shelf with a growing intensity after 2000.

***Billfish catch by state***

The reported and estimated billfish unclassified catch (kg) from the VAOS pelagic longline fishery analyzed and corrected resulted in the annual catches aggregated by states shown in **Table 1**. The analysis of all the available statistical data on billfish catches resulted in substitutions, corrections, and estimations when values were unlikely plausible knowing the regional state originating the value and the size of the fleet operating during the time the value was recorded. In the case of Vargas state, the decision was to truncate the official series in 1990 because since 1991 almost all (>90%) the billfish catch came from the artisanal gillnet fishery operating from Playa Verde. This fishery is entirely monitored by ICCAT's ERPB in Venezuela and the data is fully reported to ICCAT. In the case of Nueva Esparta state (Margarita Island), the regional entity that is the base port of almost the entire VAOS fleet (*see* SARPA, 1996; Arocha *et al*., 2013), the complete official billfish catch was substituted. The state's 1986-1997 time series was substituted with the data published by Marcano *et al.* (1994) and the complete billfish data used in Arocha *et al.* (2005); the 1998-2004 time series was substituted with the statistical data of the FONAIAP/INIA port sampling program. The catch estimates were based on sampling the landed catch in the different landing sites in Margarita Island, and raising the catch to the operations of the fleets in a given month and summed up over the year. The sampling program ended in 2005, and in 2009 the Marval and Cervigón study was published; therefore, the billfish catch reported in 2006 and 2007 by that study was selected to replace the official data because it followed a similar process of catch estimation as did the

FONAIAP/INIA port sampling program. The 2012 and 2013 catch estimates followed the same estimation process as did the FONAIAP/INIA port sampling program, which was made possible by ICCAT's JDMIP project in Venezuela. The 2005, 2008, and 2009 estimates were mean value estimates from several years as indicated in the notes of **Table 1**. The 2010-2011 values were reduced by 40%, which is INSOPESCA's raising factor for artisanal fisheries. In the case of the state of Sucre, the 2006-2013 time series was substituted by INSOPESCA's regional office data which is not subjected to any raising treatment and represents the most accurate catch statistics because is fully controlled. The catch statistics for rest of the states were considered fairly accurate, under the assumption that the landings from the western states were mostly the product of vessels operating in the surroundings of the billfish hot spot off La Guaira and landing their catch in western state ports to avoid sanctions, due to current national regulations that prohibits the VAOS fleet to land any billfish catch in the state of Vargas.

***Disaggregation of the billfish catch***

The billfish sampling program in Margarita I. (Nva Esparta) that started in 1991 with ICCAT's ERPB in Venezuela and continued by FONAIAP-INIA until 2004, and re-started in 2011-2014 with ICCAT's JDMIP Venezuelan project provided the proportion of the billfish catch by species (**Table 2**). The proportions estimated from the JDMIP Venezuelan project were in numbers of fish and were converted to weight proportions using measured mean weights from individually landed fish (**Table 3**); average weights for SPF and SPG (based on Captain/crews estimations) were estimated to be 15 and 17 kg, respectively. During the years that appeared without a proportion for any particular species (mostly SPF and SPG) was due to the absence of the species in the landed catch when the sampling took place.

Considering the results from the spatial distribution of the fishing effort which indicated that the VAOS fishery expanded operations into the Atlantic after 2000, and considering the change in the proportion of the catch after 1996, where a shift from white marlin (WHM) to sailfish (SAI) was noted, particularly during 2011-2014. It was decided that the billfish catch estimates for the western states (**Table 1**) were separated using the proportions for WHM, SAI, and BUM for the period 1986-2002; the mean proportion value for 2000-2002 was used to separate the specific catch from 2000 through to 2013 (**Table 2**).

The estimated proportions of *Tetrapturus pfluegeri* (longbill spearfish-SPF) were included in the estimates, once the species identification was confirmed that it appeared regularly in catches of the VAOS fishery. It was also decided to use a mean estimate to separate the catch of SPF for the early period because of the regularity of the species in the landings. The estimated proportions of *T. georgii* (roundscale spearfish-SPG) were included in the estimates after 2004 when it was identified in the catches of the VAOS fishery during the at-sea and port sampling programs of ICCAT's JDMIP Venezuelan project. Since SPG is not an easy species to separate and is not common in the landings, it took 2 complete years of sampling (2012 and 2013) to produce the proportion estimates. This species (*T. georgii*) was recognized in the VAOS fishery since the early years of ICCAT's ERPB in Venezuela (1994-1995) but its species status was not fully validated until 2006 (Shivji *et al*., 2006), which resulted that all spearfish-like species sampled in the VAOS fishery landings prior to 2010 were combined into one category (*i.e.*, SPF). Therefore, it is likely that the proportion of SPF that appeared in the billfish catch from the VAOS fishery prior to 2010 contained a small proportion of SPG.

***Estimated billfish catch***

The total estimated species-specific billfish catch (t) of the VAOS fishery for the period of 1986-2013 is shown in **Table 4**. The total billfish catch show a constant increasing trend that peaked in 2006 (**Figure 4**), with a very high catch of sailfish totaling 866.9 t (a potential doubtful value, *see* Discussion). Thereafter, the catches show a decreasing trend, but the catch is still higher than the early time period of the series. The high catches of the late period (after 2005) are dominated by the sailfish catch, and the white marlin catches have been largely reduced. Blue marlin catches by the VAOS fishery have remained relatively low throughout the time series.

A comparison of billfish species-specific catch across Venezuelan fisheries resulted in contrasting outcomes (**Figure 5**). The VAOS billfish estimated catches were compared to ICCAT reported billfish catches by commercial gear for Venezuela. Sailfish resulted to be the species with the highest catch in which the majority came from the VAOS fishery followed by the artisanal gillnet fishery (**Figure 5a**). However, in recent years the industrial longline catch has increased to levels matching those of the artisanal fisheries. The highest catches of blue marlin came from the artisanal gillnet fishery (**Figure 5b**), followed by the industrial longline fleet with an increasing trend in recent years. The catch landed by the VAOS fishery for blue marlin was low with the exception of the 2000 decade. The VAOS fishery produced the highest catches of white marlin of the three fisheries (**Figure 5c**) but has decreased to very low levels in recent years, the catches from the industrial longline were comparable during the early part of the time series, and thereafter the white marlin catch dropped and remained low until 2009 when it increased. The catches of white marlin from the artisanal gillnet fishery have remained at low levels throughout the time series. This comparison shows the impact of the VAOS fishery in total removals of white marlin and sailfish in the southwestern Caribbean Sea and off the Guiana's shelf in the Atlantic.

**Discussion**

The estimated species-specific billfish total catch produced by the VAOS fishery using pelagic longline gear presented in this document represents the best available estimates to date. However, the presented estimates are not free of uncertainties. Among the uncertainties, is the raising factor that INSOPESCA's main office applies to all artisanal catch. White paper documents indicate that it uses a raising factor of 40% for all species caught by the artisanal fisheries, although is not specified at what level of the statistical data is applied, whether if it is at the local level, regional, or national. Our assumption was that it was applied at the national level (main office), thus regional office data was likely to be the raw collected data. However, this may not hold for Nueva Esparta during recent years (after 2005), where a raising factor may have been applied across all species by the regional office, and applied again by the main office in Caracas, reason why INSOPESCA's values for Nva Esparta were considered to be highly inflated and were substituted by other estimates considered more accurate. Still, the published high value of sailfish for 2006 is considered to be an outlier and possibly a result of double counting in the sampling design of the Marval and Cervigón (2009) study. But since it was during the years where the INSOPESCA's data for Nva Esparta was highly inflated, it was decided to let it stand as it was but with warning of caution.

Another source of uncertainty is the operations of the VAOS fishery, some vessels use other gears than the pelagic longline (but never combined), which include drift gillnets. Some VAOS vessels of the fleet specialize in using only drift gillnets and catch a small amount of billfish and its catch is combined with the longline vessels catch. However, this uncertainty is considered to be small because the VAOS fleet using drift gillnet have different base and landing ports than those of the longline fleet, and the data used in the present estimation was mostly based from vessels using longline gear. It is believed that data improvement is possible, but it would require an exhaustive research across the country's regional offices to procure basic raw data, only possible with financial aid.

An important aspect of the estimated time series presented here is the level of importance in the billfish total removals that the Venezuelan artisanal fisheries have had in the region, and was not accounted for in recent stock assessments. In the recent white marlin stock assessment, it was indicated that one of the uncertainties was in the reported catch estimates to ICCAT. It is possible that a portion of the unreported catch of white marlin may be in the data from artisanal fisheries across the region, like the one presented in this document. It is believed from this experience that the Enhanced Program for Billfish Research continues and increases its support to enhance species-specific data collection and reconstruction from all artisanal fisheries in the area of the convention.

**References**


Arocha, F., Pazos A., Larez A. and Gutierrez X. 2015. Enhanced monitoring of large pelagic fishes caught by the Venezuela Artisanal Off-shore Fleet targeting tuna and tuna-like species in the Caribbean Sea and adjacent north-western Atlantic waters: Final analysis. ICCAT Col. Vol. Sci. Pap., 71. *In this Volume*.

Arocha, F., A. Larez, J. Marcano, A. Bárrios, X. Gutierrez, D. Debrot, M. Ortiz. 2006. Standardized catch rates for white marlin (*Tetrapturus albidus*) from the Venezuelan artisanal pelagic longline fishery off the Caribbean Sea and adjacent areas: Period 1992-2003. ICCAT Col. Vol. Sci. Pap., 315-322.

Marcano, J.S., A. Lárez, L.A. Marcano, C. Gil, H. Salazar, H. Pino. 1995. Pesquerías artesanales pelágicas del Estado Nueva Esparta: Carite y peces de pico. ICCAT Col. Vol. Sci. Pap., 44:283-245.

Marcano, L.A., J. Alió, X. Gutierrez, R. Guzmán. 1994. Análisis preliminar de la pesquería de peces de pico en la región nororiental de Venezuela. ICCAT Col. Vol. Sci. Pap., 42:319-326.

Marval, J.L., F. Cervigón. 2009. Actividad Pesquera en el estado Nueva Esparta. Fundación Museo del Mar, Editorial Ex Libris. 122 pp.

Mendoza, J., S. Booth, D. Zeller. 2003. Venezuelan marine fisheries catches in space and time:1950-1999. Fisheries Centre Research Reports, 11(6):171-180

Sarpa. 1996. Estadísticas del subsector pesquero y acuícola de Venezuela. 1990-1995. Año 1- No. 1. MAC – SARPA. Caracas. 76 pp.

Shivji, M., J. Magnussen, L. Beerkircher, G. Hinteregger, D. Lee, J. Serafy, E.D. Prince. 2005. Validity of the roundscale spearfish, *Tetrapturus georgii* (Teleostei:Istiophoridae): morphological and molecular. Bull. Mar. Sci., 79:483-492.

**Table 1**. Reported INSOPESCA and expert estimated total billfish catch (kg) of the Venezuela artisanal off-shore (VAOS) pelagic longline fishery by states for the period 1986-2013 (*see text and notes for explanation of estimated catch*).

| | | Western states | | | | | | Eastern states | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Falcón** | **Carabobo** | **Aragua** | **Vargas** | **Miranda** | **Total west** | **Anzoátegui** | **Nva. Esparta** | **Sucre** | **Total east** |
| **1986** | BIL | 11258 | 2629 | 125 | 6651 | 273 | 20936 | 312 | 25500 | 37516 | 63328 |
| **1987** | BIL | 15998 | 7685 | 277 | 12632 | 4435 | 41027 | 2412 | 21700 | 35237 | 59349 |
| **1988** | BIL | 14756 | 14653 | 586 | 29848 | 3987 | 63830 | 5088 | 20900 | 62904 | 88892 |
| **1989** | BIL | 20203 | 5219 | 812 | 19214 | 11284 | 56732 | 3123 | 55900 | 71842 | 130866 |
| **1990** | BIL | 30874 | 6980 | 158 | 35809 | 1022 | 74844 | 1163 | 61600 | 21519 | 84283 |
| **1991** | BIL | 78946 | 7097 | 973 | | 8800 | 95816 | 2164 | 111600 | 22084 | 135848 |
| **1992** | BIL | 46182 | 5082 | 753 | | 2366 | 54383 | 632 | 143500 | 25488 | 169620 |
| **1993** | BIL | 34185 | 4473 | 14 | | 1254 | 39926 | 28 | 196647 | 45343 | 242018 |
| **1994** | BIL | 14920 | 5453 | 112 | | | 20485 | 1960 | 79906 | 48284 | 130150 |
| **1995** | BIL | 37918* | 3592 | 28 | | | 41538 | | 107611 | 62985 | 170596 |
| **1996** | BIL | 45998* | 3016 | 42 | | | 49056 | | 122497 | 46810 | 169307 |
| **1997** | BIL | 66147* | 4338 | 180 | | | 70665 | 1840 | 83673 | 47787†† | 133300 |
| **1998** | BIL | 62065 | 15298 | 6360 | | 23050 | 106773 | | 355598 | 60741 | 416338 |
| **1999** | BIL | 44386 | 21888 | 5602 | | 51519 | 123394 | | 242807 | 20614 | 263421 |
| **2000** | BIL | 40691 | 4261 | 2107 | | 24160 | 71219 | 1720 | 195086 | 75786 | 272592 |
| **2001** | BIL | 42604 | 4797 | 2040 | | 43338 | 92779 | 6560 | 110869 | 37015 | 154444 |
| **2002** | BIL | 24153 | 9304 | 2204 | | 33179 | 68840 | 4523 | 140009 | 22185 | 166717 |
| **2003** | BIL | 46195 | 5240 | 5860 | | 36691 | 93986 | 4629 | 233424 | 10243 | 248296 |
| **2004** | BIL | 1561 | 15865 | 9692 | | 40001 | 67119 | 12981 | 334094 | 39885 | 386960 |
| **2005** | BIL | 979 | 1600 | 32643 | | 38454 | 73676 | 1039 | 447487♦ | 29617♦ | 478143 |
| **2006** | BIL | 1253 | 1130 | 22954 | | 46444 | 71781 | 24815 | 927230 | 49095 | 1001140 |
| **2007** | BIL | 1043 | 4701 | 47622 | | 31895 | 85261 | | 295200 | 19246 | 314446 |
| **2008** | BIL | | 280 | 195 | | | 475 | | 249253♦♦ | 28095 | 277348 |
| **2009** | BIL | | 3703 | 32311 | | 10550 | 46565 | 1761 | 249253♦♦ | 30706 | 281720 |
| **2010** | BIL | 2554 | 4074 | 20381 | | 2604 | 29612 | | 310344† | 61441 | 371785 |
| **2011** | BIL | 3912 | 1371 | 43837 | | | 49120 | 9421 | 339279† | 90957 | 439657 |
| **2012** | BIL | | | | | | 29776** | | 212579 | 37879 | 250458 |
| **2013** | BIL | | | | | | 18980** | | 134808 | 24842 | 159650 |

**Notes**. * Typo error corrected by reducing 1 order of magnitude. ** Estimated by using 2009-2010 mean values of the proportion of west/east states. ♦ Estimated using 2003-2007 mean value. ♦♦ Estimated using 2010-2013 mean value. † Estimated by reducing 40% from INSOPESCA inflated values. †† Estimated using 1995-1999 mean value.

**Table 2**. Proportion of billfish species in the catch in weight of the Venezuelan artisanal off-shore (VAOS) pelagic longline fishery recorded by ICCAT sponsored data improvement programs in Venezuela and FONAIAP/INIA program in Margarita Island. Notes: ♦1992-1995 mean value. *1996-1999 mean value. † 2011-2014 mean value.

| | WHM | SAI | BUM | SPF | SPG |
|---|---|---|---|---|---|
| **1986-1991** | 0.50♦ | 0.47♦ | 0.03♦ | 0.01♦ | |
| **1992** | 0.399 | 0.597 | | | |
| **1993** | 0.480 | 0.480 | 0.041 | 0.010 | |
| **1994** | 0.584 | 0.406 | 0.005 | 0.005 | |
| **1995** | 0.541 | 0.408 | 0.051 | | |
| **1996** | 0.485 | 0.458 | 0.050 | 0.007 | |
| **1997** | 0.424 | 0.510 | 0.061 | 0.005 | |
| **1998** | 0.441 | 0.509 | 0.041 | 0.009 | |
| **1999** | 0.431 | 0.513 | 0.052 | 0.004 | |
| **2000-2002** | 0.45* | 0.50* | 0.05* | 0.01* | |
| **2003** | 0.285 | 0.592 | 0.123 | | |
| **2004-2010** | 0.139† | 0.821† | 0.037† | 0.009† | 0.007† |
| **2011** | 0.208 | 0.752 | 0.040 | | |
| **2012** | 0.115 | 0.858 | 0.014 | 0.005 | 0.007 |
| **2013** | 0.064 | 0.909 | 0.019 | 0.002 | 0.006 |
| **2014** | 0.139 | 0.765 | 0.076 | 0.020 | |

**Table 3**. Mean dressed weight (dwt) and length of billfish species caught by the artisanal gillnet fishery in central Venezuela during 2013.

| | min | *mean* | max | n |
|---|---|---|---|---|
| **SAI dwt (kg)** | 10 | *16.87* | 39 | 4608 |
| **SAI LJFL (cm)** | 150 | *161.57* | 220 | |
| **WHM dwt (kg)** | 10 | *19.61* | 45 | 609 |
| **WHM LJFL (cm)** | 61 | *156.57* | 200 | |
| **BUM dwt (kg)** | 1 | *73.34* | 398 | 804 |
| **BUM LJFL (cm)** | 50 | *206.31* | 357 | |

**Table 4**. Total estimated billfish catch (t) by species of the Venezuela artisanal off-shore (VAOS) pelagic longline fishery for the period 1986-2013.

| | SAI | BUM | WHM | SPF | | SAI | BUM | WHM | SPF | SPG |
|---|---|---|---|---|---|---|---|---|---|---|
| 1986 | 39.8 | 2.7 | 42.2 | 0.5 | 2000 | 177.8 | 17.5 | 153.1 | 1.7 | |
| 1987 | 47.5 | 3.2 | 50.3 | 0.5 | 2001 | 123.0 | 12.6 | 110.1 | 1.0 | |
| 1988 | 72.2 | 4.9 | 76.5 | 0.7 | 2002 | 117.2 | 12.0 | 104.9 | 1.0 | |
| 1989 | 88.7 | 6.0 | 94.0 | 1.0 | 2003 | 193.8 | 35.4 | 112.5 | | |
| 1990 | 75.2 | 5.1 | 79.7 | 0.6 | 2004 | 351.1 | 17.9 | 80.7 | 3.2 | 2.3 |
| 1991 | 109.5 | 7.4 | 116.1 | 1.0 | 2005 | 429.2 | 21.6 | 95.6 | 4.0 | 2.8 |
| 1992 | 133.8 | 1.7 | 89.4 | | 2006 | 857.7 | 41.1 | 163.5 | 8.4 | 5.9 |
| 1993 | 135.2 | 11.6 | 135.3 | 2.4 | 2007 | 300.6 | 16.1 | 79.3 | 2.6 | 1.9 |
| 1994 | 61.2 | 0.7 | 87.9 | 0.7 | 2008 | 228.0 | 10.4 | 36.6 | 2.3 | 1.6 |
| 1995 | 86.6 | 10.7 | 114.8 | | 2009 | 254.5 | 12.9 | 57.7 | 2.4 | 1.7 |
| 1996 | 100.1 | 11.0 | 105.9 | 1.1 | 2010 | 320.0 | 15.4 | 62.0 | 3.1 | 2.2 |
| 1997 | 104.0 | 12.5 | 86.5 | 0.7 | 2011 | 355.2 | 20.0 | 113.3 | | |
| 1998 | 266.5 | 21.2 | 230.6 | 3.9 | 2012 | 229.7 | 5.1 | 42.1 | 1.2 | 1.6 |
| 1999 | 198.5 | 20.1 | 166.7 | 1.0 | 2013 | 154.6 | 4.0 | 18.6 | 0.3 | 0.9 |

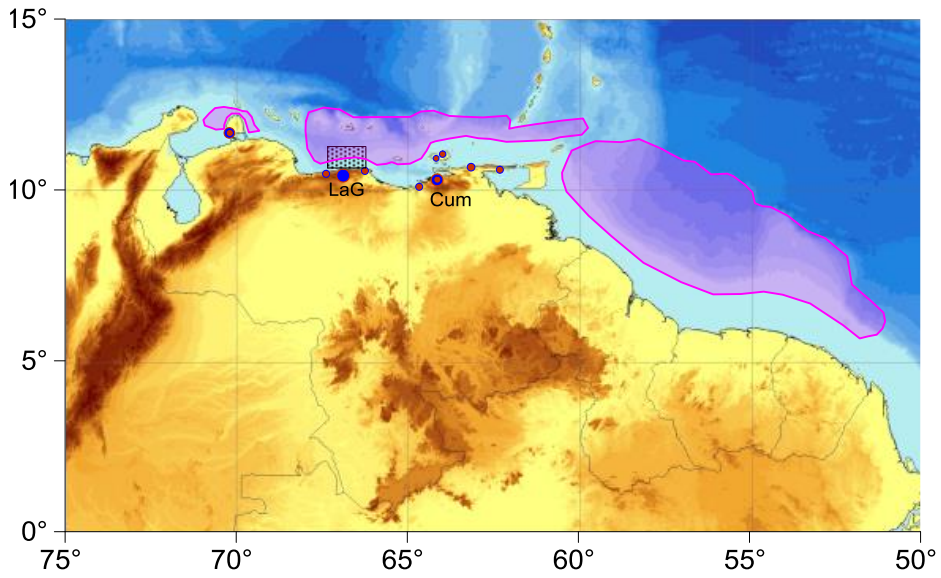


**Figure 1**. The Venezuelan Artisanal Off-Shore (VAOS) fleet fishing areas. The black rectangle represents the protected area for billfishes from industrial and semi-industrial fisheries, known as the hot spot for billfish, *i.e.*, *El Placer de La Guiara* (LaG). The red dots represent the major landing sites for the VAOS fishery. Blue dots represent important fishing ports, like Cumaná (Cum).

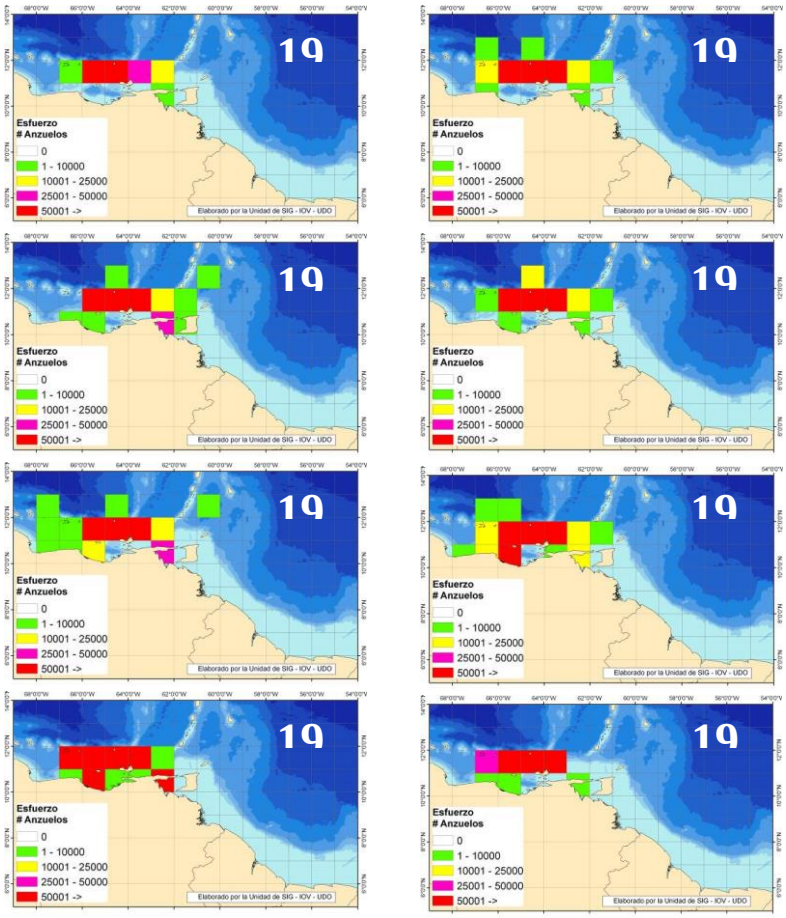


**Figure 2a**. Venezuelan Artisanal Off-Shore (VAOS) fleet spatial fishing effort in number of hooks displayed in 1°x1° square bins for the period of 1992 through 1999 obtained from the FONAIAP/INIA port sampling program.

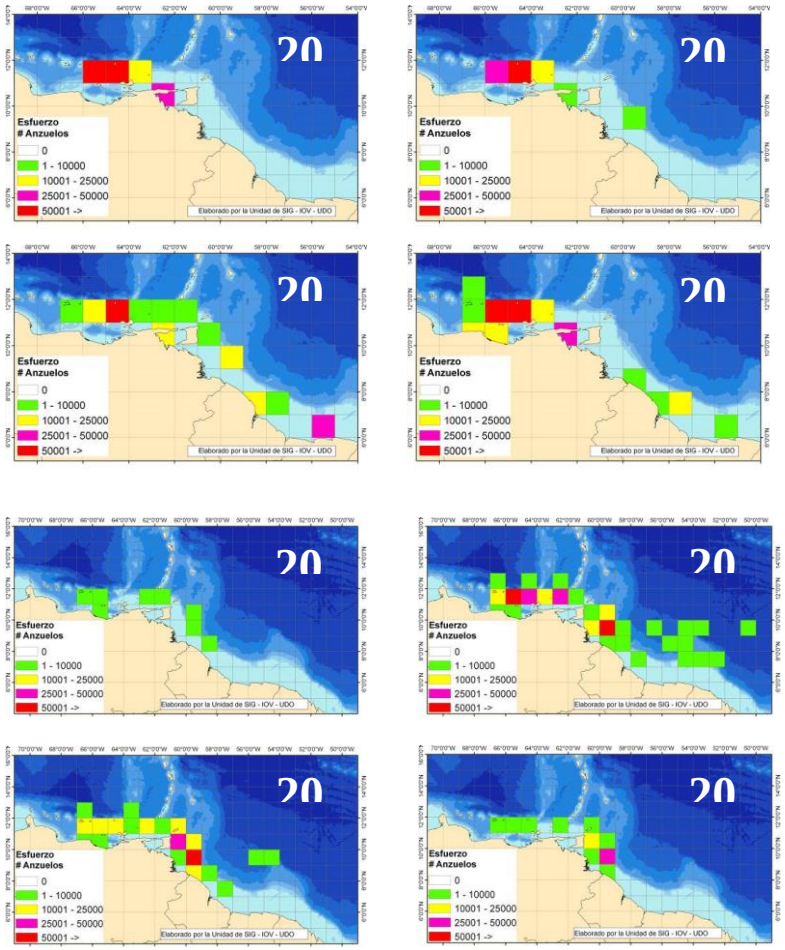


**Figure 2b**. Venezuelan Artisanal Off-Shore (VAOS) fleet spatial fishing effort in number of hooks displayed in 1°x1° square bins for the period of 2000 through 2003 obtained from the FONAIAP/INIA port sampling program, and the period of August 2011 through March 2014 obtained from at-sea sampling program of the VAOS pelagic longline fishery off Margarita Island and Morro Pto. Santo, Sucre (ICCAT's JDMIP project in Venezuela).

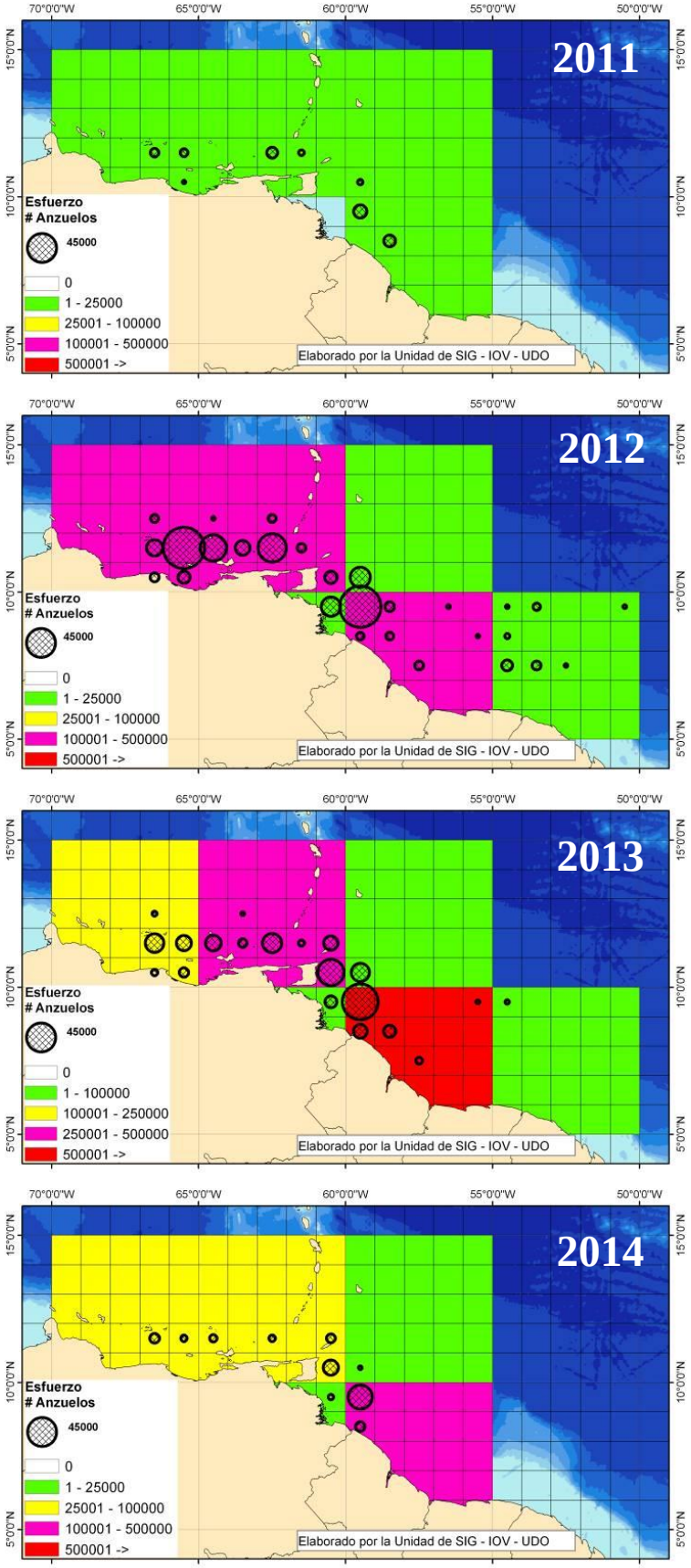


**Figure 3**. Venezuelan Artisanal Off-Shore (VAOS) fleet spatial fishing effort in number of hooks displayed in 1°x1° square bins (at-sea) and 5°x5° square bins (port) sampling programs of the VAOS pelagic longline fishery off Margarita Island and Morro Pto. Santo, Sucre (ICCAT's JDMIP project in Venezuela) for the period of August 2011 through March 2014.

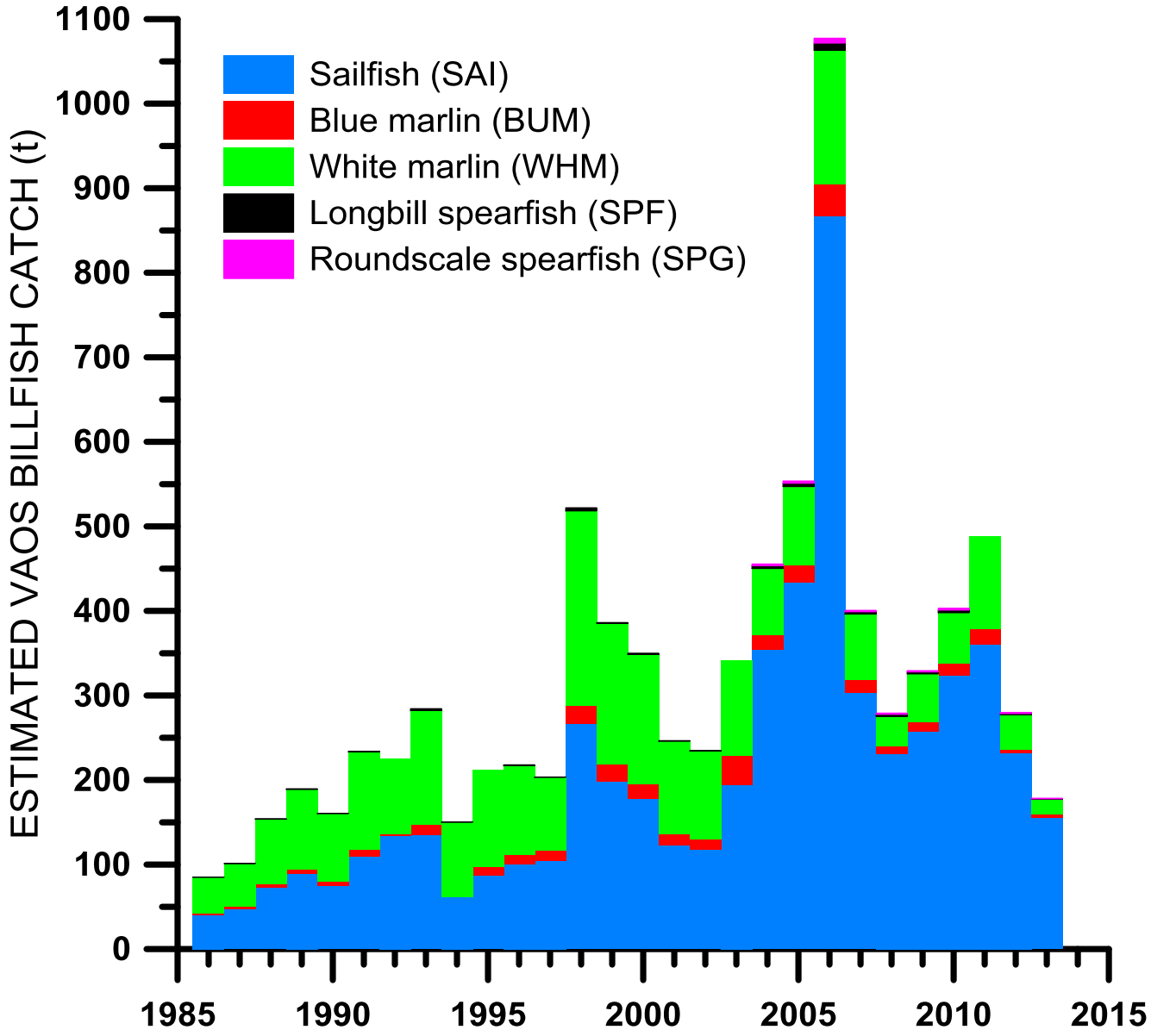


**Figure 4**. Total estimated species-specific billfish catch (t) of the VAOS fishery for the period of 1986-2013.

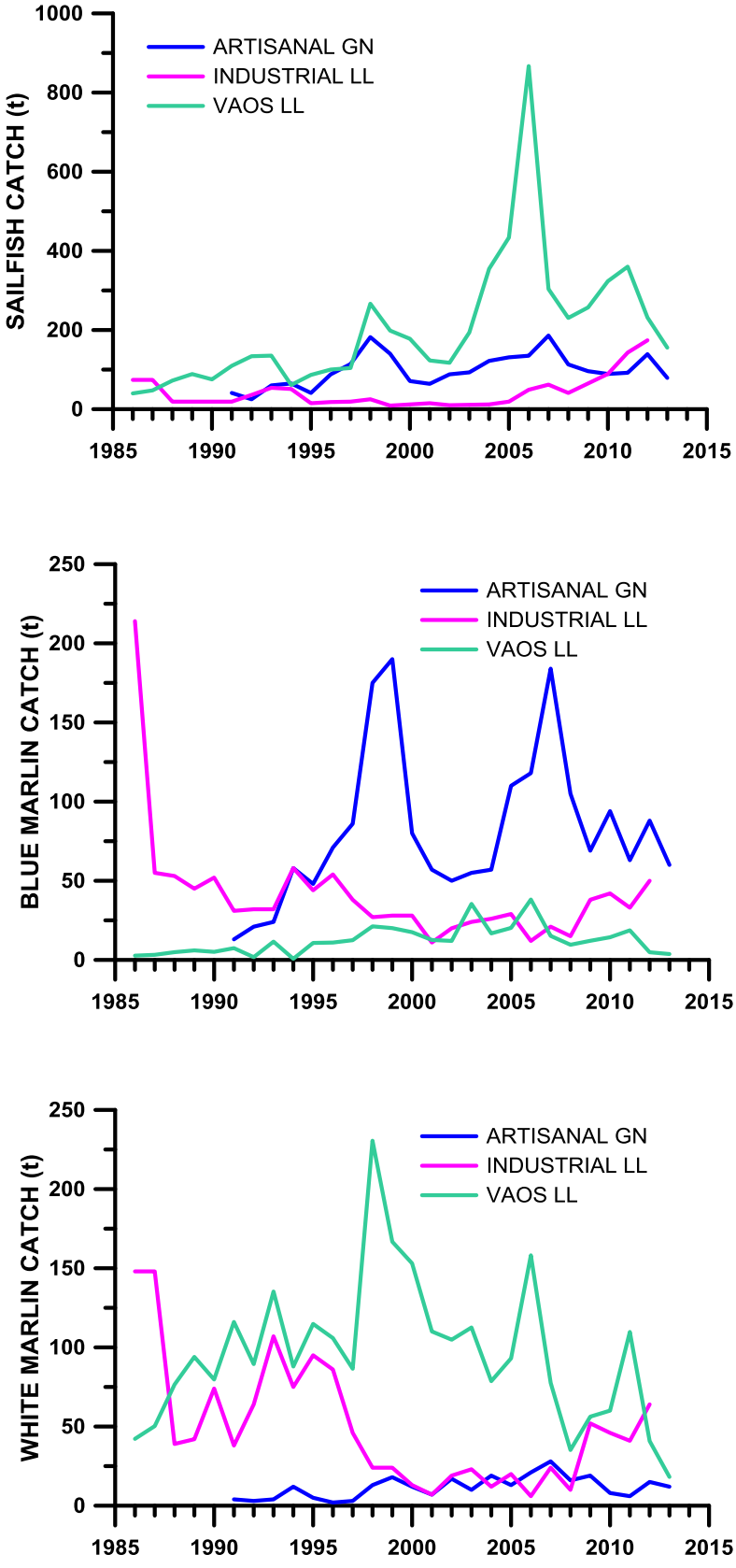


**Figure 5**. Total estimated species-specific billfish catch (t) by Venezuelan fleets for the period of 1986-2013. Sailfish (a, top graph), blue marlin (b, middle graph), and white marlin (c, bottom graph). Industrial LL and artisanal GN data were obtained from ICCAT task 1 data, VAOS LL data are from present document.