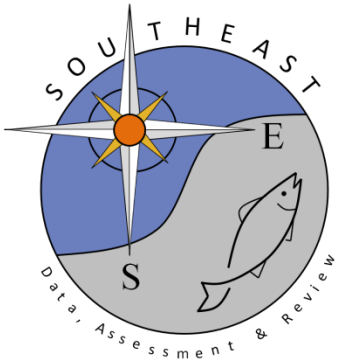
Sampling History of the King Mackerel Commercial Fisheries in the Southeastern United States by the Federal Trip Interview Program (TIP)

Courtney Saari

SEDAR38-DW-09

22 November 2013



Please cite this document as:

Saari, C. 2013. Sampling History of the King Mackerel Commercial Fisheries in the Southeastern United States by the Federal Trip Interview Program (TIP). SEDAR38-DW-09. SEDAR, North Charleston, SC. 13 pp.

Sampling History of the King Mackerel Commercial Fisheries in the Southeastern United States by the Federal Trip Interview Program (TIP)

Report by:
Courtney R Saari
IAP World Services
NOAA NMFS
Southeast Fisheries Science Center

November 22, 2013

Summary

The Trip Interview Program (TIP) was developed by the Southeast Fisheries Science Center (SEFSC) in the 1980s as part of the State-Federal Cooperative Statistics Program. The primary information collected by the TIP includes effort and landings details, length frequencies, and biosamples for federally managed species. Over the history of TIP, the sampling methods have changed to address the management needs. Throughout TIP's history, king mackerel has been listed as one of the high priority species for biosampling. Sampling of the commercial king mackerel fisheries began in the mid-1980s with random length frequency sampling (RLS). RLS continued in the 1990s with additional sampling for age-length keys (ALK). In the 2000s, RLS continued while otolith collection methods switched from ALK to random age sampling (RAS).

This report will: (1) summarize the historical sampling guidelines of the TIP in the Southeastern United States and (2) explain the sampling design and the sampling history with regards to the commercial king mackerel fisheries. All information presented in this report represents Federal TIP sampling. It should be noted that the TIP database contains samples from non-commercial fishing trips as well; however the sampling procedures for non-commercial samples might not adhere to the TIP sampling procedures.

Introduction

The Trip Interview Program (TIP) was developed by the Southeast Fisheries Science Center (SEFSC) in the 1980s as part of the State-Federal Cooperative Statistics Program (Zweifel 1988). The primary focus of this shore-based sampling program is the collection of detailed commercial fishery information on the level of individual trips. The TIP mandate is to obtain representative samples from federally managed species for which age information (Biosampling) is needed for stock assessments (Saari and Beerkircher 2013). Biological samples include morphometric, age, reproductive, and genetic data. In addition to collecting biological data, the TIP serves as a quality assurance on catch and effort data. It can sometimes validate the species composition of the landings as well as the type and quantity of gear through first hand, trained observation. Other important information, obtained through personal interviews with the fishermen and dealers, also serves the quality assurance purpose.

TIP sampling has been accomplished under a joint state-federal effort throughout the southeastern states, with coverage variability contingent on funding and fishery activity. Currently, there are approximately 20 Federal TIP samplers strategically placed throughout the Southeastern United States, with 1 sampler in smaller states, 2-4 samplers in larger states, and 5-10 samplers in Florida. Placement of samplers is in conjunction with the areas of high landings of federally managed species.

Historical TIP Guidance

When TIP began in 1983, the four main objectives were to 1) estimate the number of fishing trips by fishery and gear type; 2) obtain size frequency samples on a species priority basis; 3) obtain information on species composition in mixed catches; and 4) obtain representative samples of landings, areas of fishing, effort, catch per unit effort and price by size of fish (Zweifel 1988). At this time, TIP sampling primarily focused on size frequency sampling of reef fish species (snappers and groupers) and king and Spanish mackerel. The original TIP Operations Manual was first revised in May 1988. The 'Operations Manual for the Trip Interview Program in the State/Federal Cooperative Statistics Program (TIP)' was distributed to port agents in August 1988. This comprehensive manual included (i) an introduction to the program, listing the requirements and objectives, followed by (ii) procedures for data collection, which included both a purpose and methods section for the major components, (iii) descriptions of the data file structure, (iv) details for data processing and management, (v) data forms and field instructions, and several appendices. This manual instructed samplers to obtain samples that are "representative in kind (e.g. species and size), in quantity (numbers and weight) and of fishery conditions" as well as representative of the "time-area stratum"; and briefly discussed the essentials for unbiased sampling. This manual also included regional priority species lists with annual quotas for each species and priority level assigned by gear and subregion.

Throughout the 1990s and early 2000s, TIP samplers were provided with memoranda outlining the sampling targets and sampling methods. Samplers also had two primary guides that outlined program goals, sampling methods, and data entry; the TIP User's Guide (Zweifel 1988) and the Bioprofile Sampling Manual (Palko 1990), both of which have been periodically updated and redistributed. Annual or biannual port sampler meeting have been held since 1998 to facilitate discussion among samplers, train and update samplers on new protocols, and include skills workshops.

The annual guidance provided throughout the 1990s included priority species lists and target sample numbers. These lists were typically divided by state with length and otolith quotas for each priority species. There were two regional priority species lists produced each year, one for the South Atlantic states and the other for the Gulf of Mexico states. For example, in 1992 the South Atlantic "TIP Bioprofile Data Needs" list focused on reef fishes, listing 17 species and 9 species groups in decreasing order of priority, with length and otolith quotas for each state, and instructions to only collect low-priority species after reaching the quotas for higher priority species. The length target numbers were typically three to ten times greater than the target numbers for otoliths. In 1993, the target sample numbers were based upon the previous year's priority species lists for each region and the total numbers of lengths and otoliths collected by agent and region. This list gave species-specific instructions for biosamples (otoliths, gonads, spines) and the laboratory to send each to. All king mackerel samples were to be sent to the NMFS Panama City laboratory. The general instructions were to collect otoliths from the target species in 10 centimeter increments and to record the sex of each fish for the development of age length keys.

The NMFS Panama City Laboratory's "Bioprofile Sampling Manual" was revised in 1990 and adapted for the TIP in 1992. With the addition of this manual, TIP samplers began to collect hard parts for the compilation of age-length keys for target species. However, consistent collection of otoliths did not occur until the mid to late 1990s. This Bioprofile Manual was divided into four sections: (1) length sampling, (2) otolith/head/dorsal spine collections, (3) tissue collections, and (4) standard codes for data entry; and included a priority species list without target quotas. The primary sampling focus was on

length frequencies of mackerels, snappers, groupers, and coastal pelagics, followed by incremental sampling of mackerel otoliths.

In 1994, managers redefined the objectives of the TIP for the Southeastern U.S. (not the Caribbean TIP) in order to adjust to the evolving management needs, financial restrictions, and launch of the fishery logbook programs. In this redefinition, the original four objectives were reduced to one primary objective: "To obtain size frequency samples on a species priority basis, although age and sex data may be collected on a sub-sampling basis." A sampling guidelines document was also produced giving broad standards to guide the TIP sampling efforts. This document provided guidance on the following five aspects of TIP: 1) species selection, 2) where to sample, 3) trip selection, 4) fish selection, and 5) data to collect. The species and location selection guidelines included a primary target species list of 29 species for which stock assessments are conducted and a list of counties where greater than 50,000 pounds of these species were landed in the previous year. Annual target numbers of fish to measure were provided for each species on the assessment list, with separate targets for the Gulf of Mexico and South Atlantic regions. The trip selection guidelines directed samplers to focus on commercial fisheries that targeted species on the assessment list. They also advised that samples should come from a variety of commercial gear types and vessels, with a target goal of interviewing 10 to 20 percent of the trips in the area. The fish selection guidelines stated that "the fish should be measured to provide data that are as representative as possible of the catch" and discussed bias and the importance of selecting fish randomly. There were also brief criteria for obtaining representative samples from sorted catches (selecting fish from each size category) and unsorted catches (selecting every 3rd or 5th fish). Sample target numbers were not set for individual trips; however, annual targets were provided with guidance that sample numbers will vary based on variability of fish size in the landings.

From 1995 through 1997, the samplers were given region-specific and species-specific protocols that included a combination of incremental otolith sampling for age-length keys and random length frequency sampling. Several of the protocols required sex identification and a few included requests for gonad collection and individual fish weights.

In 1998, the Trip Interview Program saw numerous updates. Along with the annual updated priority species lists and sampling memorandums, the first annual port sampler meeting was held for Gulf of Mexico state and federal samplers by FIN, and the updated TIP User's Guide (version 3.4) was distributed. There was also an addition of several new port samplers. The two primary objectives of the port samplers' meeting were to review the (1) commercial data collection methods and sampling protocols, and (2) individual data elements of the TIP. Discussions of sampling protocol addressed the guidelines for trip selection, priority species and sampling targets, measurements required, and how to determine sex. Meeting discussions also focused on the updates to the TIP User's Guide, which were set to take effect on August 1, 1998. The high priority species lists included month and trip quotas for lengths, otoliths, and gonads for each species.

The TIP User's Guide was updated in 1999 and again in 2001 to include updated sampling guidelines and reporting form procedures (Molina, 1999; Molina 2001). The procedures for sample selection shifted from the ALK method to random age sampling (RAS). The updated priority species list given in 2001 included a total of 37 assessment species, with 7 snappers, 6 groupers, 2 mackerels, 3 jacks, 2 invertebrates, and other reef fish, and was not region-specific. The sampling protocol directed samplers to sample more individual fishing trips instead of taking more measurements from a small number of trips, with a target number of measuring 30 (or up to 30) fish per species per trip, and a maximum of 50 measurements per species for large landings. The User's Guides emphasized the importance of random

sampling for data that are as representative of the catch as possible. At the annual port sampler meeting in 2001, an otolith removal and processing workshop was held to train samplers in species-specific otolith extraction techniques. The example species included red snapper, king mackerel and southern flounder.

In 2002, the port samplers were given updated region-specific sampling protocols for the 2002 and 2003 seasons. These documents consisted of priority species lists with information about the seasons and regulations, and target quotas for lengths, otoliths, and gonads per month and trip. Each list was sorted in order of descending priority and included month and trip quotas for lengths, otoliths, and gonads for each species. Typical monthly quotas included 50 lengths and 30 otoliths per species, with trip limits of 30 lengths and 30 otoliths (an increase from the 1990s lists). Several samplers recall focusing their sampling efforts first on reaching the otolith quotas for each trip and month, then collecting length frequencies after they met the otolith quotas. From 2002 through 2004, the samplers continued random otolith sampling based upon the priority species quotas, followed by length frequency sampling.

In 2004, the new TIP Online data entry program (TIPOL) was introduced to the port samplers. The annual port sampler meeting was held in Panama City, FL, and included discussions concerning TIPOL, otolith collection, ComFIN, and hurricane impacts on commercial fishing. There was also a training workshop for otolith processing and removal. Coinciding with TIPOL, the port samplers began using year-long consecutive tag numbers for the otoliths they collected. Also in this year TIP sampling began to phase out the collection of incremental lengths and length frequencies. Sampling priority switched to otolith collection, which required exact length measurements, thus the reporting of incremental lengths with punch boards was discouraged. Also in 2004 NMFS began a reevaluation of the TIP, which included database analysis and port sampler interviews.

In 2005 the numbers of otolith samples continued to rise as the length frequency numbers were phased out. By the end of 2005 about 50 to 70% of the port samplers stopped collecting length frequency data and only collected lengths with otoliths. It appears that the majority of port samplers who made the switch [to only recording length measurements if they collected otoliths] were in the Gulf of Mexico. Most of the South Atlantic port samplers and a couple of samplers in the Gulf focused their sampling efforts on collecting otoliths, but they continued to collect length measurements from fish if they were unable to collect otoliths from those specimens. These samplers primarily collected more length measurements from mackerels because of the requirement for sex identification with otolith collection.

The 2005 port sampler meeting was held in St. Petersburg, FL. Meeting discussions included fisheries management, the status of ComFIN, the TIP Online program, and the assessment concerns for gag and black grouper. Workshops were held on shark identification and tilefish otolith removal techniques. The final report on the *Reevaluation of the Trip Interview Program* was completed in October 2005, and recommended 9 major changes in the TIPOL data structure. Also in the mid-2000s, there were numerous debates on sample size. In 2007, two NMFS reports recommended TIP sampling targets for 15 commercial fisheries in each region. Each species-specific list was sorted by state, gear, and sample type. These lists also included a general sampling guideline of at least 30 samples from each trip, with more lengths than otoliths as time permitted. Following receipt of this guidance, most samplers restricted their otolith collections to 30 otoliths per species per trip. It appears that priority species lists ended in the mid-2000s and were replaced with guidance to collect random samples that are representative of the fisheries landings in each region. Most samplers continued RAS for the primary species landed each trip.

The next port agent meetings were held annually from 2007 through 2010. These meeting included presentations, group discussions, field trips to local fish houses, and sampling workshops. The presentations included information on research and biosampling, stock assessments, the observer programs, the electronic trip ticket program, the red snapper, grouper and tilefish IFQ programs, and law enforcement issues. With the introduction of the red snapper IFQ program in the Gulf of Mexico, port samplers gained a new method for selecting vessels to sample (landing notifications). The sampling workshops addressed representative sampling, otolith removal, and shark identification.

To increase coverage of trips interviewed, five additional contract port samplers were added in the Gulf of Mexico in 2012. In 2013, they began taking individual fish weight measurements along with lengths and otoliths, while the majority of federal samplers continued to report only length measurements and otolith collection. The next port sampler meeting was held in 2013 to introduce the updated TIP User's Guide (Version 5.0) and address the new standards for sampling and data reporting. The updated standards include the continuation of RLS and RAS for all federally managed fisheries and their associated catches. The federally managed fisheries that TIP focuses on include reef fish and the snapper-grouper complex, mackerels and coastal pelagics, the jacks complex, and spiny lobster (in the South Atlantic, golden crabs are also federally-managed). The guidance states that fish selection should be representative of the species landed in each region, and samples should be randomly selected from the entire landings for each trip interviewed. The updated TIP User's Guide also included definitions for all codes used in TIPOL, detailed appendices outlining example sampling situations, common gear (fishing gear, sampling gear, and dealer-site containers), and cross-checking instructions, as well as links to reference documents for more information. Detailed guidance was provided for the identification of trip information (data fields 'Interview Type' and 'Information Source') and the reporting of non-random samples through the data fields 'Sample Method', 'Is Random' and the 'Comments' section. All changes addressed at this meeting will be implemented by January 1, 2014.

King Mackerel Sampling by the Trip Interview Program

Throughout TIP's history, king mackerel has been listed as one of the high priority species for biosampling. Prior to 1990, TIP sampling primarily collected random length frequency data. For random length sampling (RLS), a random sample of the landed catch is taken and the length of each fish is measured. For king mackerel, and most coastal pelagics, the standard length measurement has been fork length (centerline measurement from the tip of the snout to the posterior end of the middle caudal rays) reported in centimeters. Fish lengths are typically measured on a board with a built in meter stick. If the fish is longer than the board, a measuring tape is used. This method provides an exact measurement for each fish. The second method used to collect length frequency data is accomplished with a punch board. A punch board is a modification to the conventional measuring board, where a data sheet (with a measuring scale) overlays the board and lengths are recorded by punching holes in the data sheet. After sampling is complete, the numbers of holes per length interval (usually 0.5 cm or 1.0 cm) are tallied and counts of fish per length interval are reported. Along with the length frequency data, sex identification was also reported if the samplers were allowed access to the fish's body cavity or if the gutted fish retained a portion of the gonads. Sex was recorded as male, female or unknown. During the 1980s, the majority of king mackerel random length sampling was collected from the eastern and southern coasts of Florida, with limited sampling in Georgia and South Carolina. The majority of lengths reported were exact lengths (<15% per year were incremental lengths). Sex was identified for less than 5% of the fish measured in the early-mid 1980s, increasing to 70-90% of the measured fish in the late

1980s. Samplers were also given the option to obtain weights from individual fish, but this was not a required measurement less than 5% of the king mackerel sampled each year were weighed.

In the early 1990s, samplers began collecting otoliths along with the length frequencies from king mackerel and red snapper, for the purpose of developing age-length keys. Collection of otoliths followed the guidelines of the *Bioprofile Sampling Manual,* which was produced by the NMFS Panama City Laboratory in 1990 and adapted for the TIP in 1992. These guidelines instructed samplers to remove otoliths from fish that were already randomly selected for length frequencies. While otolith collection began in 1991, the primary focus was on length frequency sampling and consistent collection of otoliths did not occur until the mid to late 1990s. In 1991 and 1992, otoliths were collected from approximately 5% of the king mackerel sampled for random length frequencies. The percentage of king mackerel length samples with otoliths increased to 15% in 1995 and 20% in 2001 (Table 2).

During the early 1990s, the majority of king mackerel samples were collected from the eastern and southern coasts of Florida, with limited sampling in Georgia, South Carolina, Mississippi, and Louisiana (Table 1). The majority of lengths reported were exact lengths (<10% per year were incremental lengths) with sex identified (70-90% per year had sex id). Gonads and weights were also collected from a small portion (<2% and 5% per year, respectively) of the king mackerel sampled.

In 1993, the sampling protocol continued random length sampling (RLS) with additional sampling for the development of age-length keys (ALK). The ALK protocol was to collect otoliths from the target species in 10 centimeter increments and to record the sex of each fish. The historical data show the majority of samples taken in the early 1990s were lengths. Of the otoliths that were collected, the majority in both regions were from king mackerel (20-40%), followed by gag and red grouper in the Gulf of Mexico (30-50%) and tilefish and Spanish mackerel in the South Atlantic (10-30%). However, otoliths were collected from less than 5% of the king mackerel that were measured for length frequencies and appear to have been collected via random age sampling (RAS) instead of by ALK methods. Despite memorandums listing target numbers of otolith samples in the early- and mid-1990s, it appears that targeted otolith collection started several years later in the Gulf of Mexico (1998) than in the South Atlantic (1995). Of the otoliths that were collected in the Gulf from 1992 through 1996, the dominant species were king mackerel and red grouper.

Starting in 1995 and continuing through 2001, the protocol for king mackerel sampling included a combination of random length sampling (RLS) and age-length key sampling (ALK). The ALK method is also known as incremental otolith sampling, and included an annual target of 20 otoliths per sex per 10 cm increment for king mackerel. In the late 1990s, the annual target was changed into a semi-annual target in order to collect otoliths year-round from younger fish (ages 0-2 yr) to better account for their significant growth differences in the age-length keys.

Regardless of the method used to collect otoliths (ALK or RAS), samplers were required to identify the sex of the king mackerel in order to collect an otolith; i.e. samplers were instructed not collect otoliths if they were unable to identify the sex of the fish. From the historical data and interviews with veteran port samplers, it appears that only the samplers on Florida's east coast followed the incremental sampling procedure followed by length frequencies once the otolith quotas were reached or when they were unable to identify a sex. The samplers located on Florida's southern and western coasts performed RLS with opportunistic and random collection of otoliths from king mackerel, as most of the fish in these regions were landed gutted and thus they were unable meet the sex identification requirement for

otolith collection. This limitation kept the samplers from reaching the targets for ALK sampling and instead they collected otoliths via the RAS method.

From 1995 through 2000, otoliths were collected from 10-20% of the king mackerel measured for length data each year (Table 2). In 1995, the port samplers in the western Gulf of Mexico were instructed to heavily increase their TIP sampling for red snapper, and thus sampling of king mackerel decreased in this region. From 1995 through 2007, nearly 100% of the king mackerel sampled from the commercial fisheries were sampled in Florida. Starting in 1996, gonad collection from mackerels was no longer required. Also in 1996, a data request was sent to the port samplers on the east coast of Florida requesting otoliths from female king mackerel with a fork length of 80 to 95 cm. Following this request there was an increase in samples from large females, thus caution should be used when incorporating this data into sex ratios and age composition. Most of these fish should be distinguishable in the TIP database because the samplers identified these interviews as having a size bias; however they did record the samples as being randomly collected.

Samplers were given guidance to use the variables of bias type, sample method, and the field 'is random' to distinguish between fish selected randomly for random length and age sampling (RLS and RAS) verses fish that were targeted to meet biological sampling quotas, such as incremental ALK sampling, and special requests, such as the one for samples from large females. However, very few samplers reported incremental otolith samples as non-random samples with the sample method of Quota Sampling. Throughout the 1990s, 100% of otoliths collected were designated as randomly collected and 98% in the 2000s. A few samplers did report a size bias when targeting fish to meet quotas for incremental otolith collection; 5-30% of the samples each year were reported with a size bias.

In 1999, the procedures for sample selection shifted from the ALK method to RAS, calling for agents to randomly select up to 30 samples (maximum of 50) that are representative of the targeted fishery. It appears that incremental sampling of king mackerel otoliths ended in 2000. However, one sampler continued to collect otoliths by the ALK method until 2002 or 2003. The majority of the samplers employed a combination of the RLS and RAS methods to sample king mackerel from 2000 through 2003.

Following the switch to RAS sampling in the early 2000s, the sampling protocols included monthly quotas of 50 lengths and 30 otoliths per species, with trip limits of 30 lengths and 30 otoliths. Samplers also received updated guidelines for mackerel sampling, including background information about age and growth analysis, procedures for otolith removal, cleaning and mailing, and the requirement to only collect otoliths from mackerels with intact gonads for sex identification. Several samplers recall focusing their sampling efforts first on reaching the otolith quotas for each trip and month, then collecting length frequencies after they met the otolith quotas.

In 2004, TIP samplers were instructed to phase out the collection of incremental lengths and length frequencies. Sampling priority switched to RAS otolith collection, which required exact length measurements, thus the reporting of incremental lengths with punch boards was discouraged. Despite this guidance, one sampler continued to collect king mackerel length frequency data via punch boards throughout the 2000s.

In 2005, the numbers of otolith samples continued to rise as the length frequency numbers were phased out. By the end of 2005, about 50 to 70% of the port samplers stopped collecting length frequency data and only collected lengths with otoliths. It appears that the majority of port samplers who made the switch [to only recording length measurements if they collected otoliths] were in the Gulf of Mexico.

Most of the South Atlantic port samplers and a couple of samplers in the Gulf focused their sampling efforts on collecting otoliths, but they continued to collect length measurements from fish if they were unable to collect otoliths from those specimens. These samplers primarily collected more length measurements from mackerels because of the requirement for sex identification with otolith collection. Otoliths were collected from 20-30% of the king mackerel sampled each year compared to 60-90% of the red snapper and gag grouper sampled each year.

In the mid-late 2000s, most samplers used the RAS method to 30 otoliths per king mackerel trip sampled, followed by RLS. However, several samplers did not restrict the number of otoliths they collected per trip, some with more than 50 otoliths per king mackerel trip. Overall, otoliths were collected from 20-40% of the king mackerel sampled each year (Table 2). Starting in 2008, king mackerel sampling expanded to include samples from North Carolina, Alabama, Louisiana and Texas. In 2012, the samplers received confirmation that king mackerel otoliths should only be collected when it is possible to collect sex identification as well. However, they were instructed to collect length measurements if they could not collect otoliths. To increase coverage of trips interviewed, five additional contract port samplers were added in the Gulf of Mexico in 2012, increasing otolith collection to 65% of the king mackerel sampled. In 2013, the five contract TIP samplers in the Gulf of Mexico began taking individual fish weight measurements, thus increasing the former average of recorded weights for 5% of king mackerel sampled each year to 20%.

In September 2013, a TIP port agent training meeting was held to standardize the sampling and data reporting procedures. All changes addressed at this meeting will be implemented by January 1, 2014. The updated standards include the continuation of RLS and RAS for all species including king mackerel, and detailed guidance for the reporting of non-random samples through the use of the data fields 'Sample Method' and 'Is Random.'

King Mackerel Sampling by State samplers for the Trip Interview Program

The state TIP samplers have been provided with the TIP Manual and updates to the TIP User's Guide. However it is unclear how closely state samplers have adhered to the TIP sampling protocols. From personal communications with the state TIP samplers in South Carolina and Florida, it appears that they have been following the TIP guidelines. It appears that the majority of their samples are selected via the RLS and RAS methods with limited quota sampling.

The contribution of king mackerel samples from TIP's state partners varies greatly throughout TIP's history (Table 3). The majority of samples reported by state samplers are length data (Table 4). Samplers from Louisiana, Florida, Georgia, South Carolina and North Carolina sampled the king mackerel commercial fisheries throughout the 1990s and 2000s. State samples from Louisiana accounted for nearly 100% of the king mackerel length measurements from 1983 through 2010. Alabama samplers account for the majority of king mackerel length measurements prior to 2008, and about 25% of the measurements from 2008 through 2012. State samplers have reported 100% of the king mackerel samples (lengths and otoliths) for South Carolina since 1993. Prior to 1993, Federal TIP samplers collected the samples for South Carolina. The state samplers in Texas and North Carolina do not participate in TIP; however North Carolina does send their data annually to be imported into the TIP database. Therefore, the North Carolina state samples account for nearly 100% of the lengths collected in the 1980s, 1990s and early 2000s. Overall, the Florida state samplers have provided approximately 20% of the length measurements and 5% of the otoliths collected for king mackerel in the state of Florida (Federal and State samples combined). From 1984 through 2002 the majority of the length

samples reported by the Florida state samplers were 'punch board' data for length frequencies. The only other state to report length frequencies instead of exact lengths was South Carolina in 1991 and 1992.

References

1994. Trip Interview Program (TIP) program definition. USDC/NOAA/NMFS Southeast Fisheries Science Center.

1994. Sampling guidelines for Trip Interview Program. USDC/NOAA/NMFS Southeast Fisheries Science Center.

1997. Trip Interview Program procedures guide for data managers. USDC/NOAA/NMFS Southeast Fisheries Center.

Bishop, Laura L. 1997. TIP reporting form procedures – Quick reference – Revision – Part I: TIP data entry system 3.2 (original author Dr. Ausbon Brown, Jr.). USDC/NOAA/NMFS Southeast Fisheries Science Center.

Bishop, Laura L. 1998. User's guide: Data collection and reporting form procedures for SEFC's Trip Interview Program (TIP). Version 3.4. USDC/NOAA/NMFS Southeast Fisheries Science Center.

Epperly, Sheryan P. 1984. S/F Bioprofile manual for North Carolina. North Carolina Division of Marine Fisheries. 86 pages.

Gold, Susan M. 1990. User's guide for the microcomputer based data entry portion of Trip Interview Program (TIP). Data entry system version 3.0. USDC/NOAA/NMFS Southeast Fisheries Science Center.

Molina, Susan. 1999. User's guide for the Trip Interview Program (TIP). Data entry system version 4.0. USDC/NOAA/NMFS Southeast Fisheries Science Center. 336 pages.

Molina, Susan. 2001. User's guide for the Trip Interview Program (TIP). Data entry system version 4.0. USDC/NOAA/NMFS Southeast Fisheries Science Center.

Palko, Barbara Jayne. 1990. Bioprofiles sampling manual. USDC/NOAA/NMFS Panama City Laboratory.

Prytherch, Herbert F. 1978. A survey designed for the collection and analysis of data for the reef fish program. USDC/NOAA/NMFS Southeast Fisheries Science Center. 61 pages.

Saari, Courtney R. and Lawrence R. Beerkircher. 2013. User's guide for the Trip Interview Program (TIP). Version 5.0. USDC/NOAA/NMFS Southeast Fisheries Science Center.

Zweifel, James R. 1988. Operations Manual for the Trip Interview Program in the State/Federal Cooperative Statistics Program (TIP*). USDC/NOAA/NMFS Southeast Fisheries Science Center. 115 pages.

Zweifel, James R. and Susan Gold. 1988. Trip Interview Program data entry and editing system, User's Handbook version 2.1. USDC/NOAA/NMFS Southeast Fisheries Center. 54 pages.

Reference sources also included:

- Personal communications with Federal and State TIP samplers, the current TIP supervisor, and NMFS scientists who process the TIP samples. 2012-2013.
- Memorandums sent to the TIP samplers from the TIP coordinators and supervisors.

Table 1. Number of king mackerel measured for random length sampling per year and state collected by Federal TIP samplers.

	AL	FL	GA	LA	MS	NC	SC	TX
1984		150	187				0	
1985		3,566	137				853	
1986		2,796	138				553	
1987		5,568	93				723	
1988		4,103	77				558	
1989		3,088	55				315	
1990		6,528	0				508	
1991		9,457	228		1		361	
1992		10,691	54	767			360	
1993		9,601	46					
1994		7,654	32					
1995		5,165						
1996		9,980						
1997		4,715						
1998		7,331						
1999		11,932			1			
2000		11,251						
2001		8,074						
2002		6,280						
2003	3	7,959						
2004		3,605		5				
2005		3,538						
2006		3,768						
2007		2,506						
2008	168	3,320		1		236		4
2009	172	4,941				531		10
2010	215	5,332				144		
2011	233	4,083		2,393		49		
2012	313	3,308		2,807	77	303		9

Table 2. Number of king mackerel sampled for length and percentage of those lengths sampled for age per year and state collected by Federal TIP samplers.

	AL		FL		GA		LA		MS		NC		SC		TX	
1984			150	0%	187	0%							0	0%		
1985			3,566	0%	137	0%							853	0%		
1986			2,796	0%	138	0%							553	0%		
1987			5,568	0%	93	0%							723	0%		
1988			4,103	0%	77	0%							558	0%		
1989			3,088	0%	55	0%							315	0%		
1990			6,528	0%	0	0%							508	0%		
1991			9,457	0%	228	0%			1	0%			361	0%		
1992			10,691	0%	54	0%	767	0%					360	0%		
1993			9,601	0%	46	0%										
1994			7,654	0%	32	0%										
1995			5,165	14%												
1996			9,980	12%												
1997			4,715	20%												
1998			7,331	12%												
1999			11,932	6%					1	0%						
2000			11,251	9%												
2001			8,074	23%												
2002			6,280	19%												
2003	3	66%	7,959	16%												
2004			3,605	29%			5	100%								
2005			3,538	23%												
2006			3,768	20%												
2007			2,506	38%												
2008	168	99%	3,320	35%			1	100%			236	53%			4	100%
2009	172	27%	4,941	22%							531	59%			10	100%
2010	215	54%	5,332	20%							144	95%				
2011	233	52%	4,083	17%			2,393	100%			49	80%				
2012	313	33%	3,308	41%			2,807	100%	77	34%	303	53%			9	89%

Table 3. Number of king mackerel measured for random length sampling per year and state collected by State TIP samplers.

	AL	FL	GA	LA	MS	NC	SC	TX
1983				3,821		20		
1984		4,909		16,982		554	777	
1985		6,083		5,808		1,066		
1986		4,441	90	649		1,471		
1987		331		2,238		1,130		
1988		48		426		824		
1989		1		1,389		835		
1990		17		271		1,511		4
1991		189		1,789	3	1,266	320	
1992		182		2,323	3	810	563	
1993		371		849		471	586	
1994		709		1,167		275	169	
1995		572	63	621		227	385	
1996		1,298	14	331		346	469	
1997		589	15	370		141	552	
1998		1,702	14	38		239	437	
1999		1,020	23			714	635	
2000		1,250	18	58		1,170	853	
2001		1,162	23	6		740	633	
2002	1	951	5	299		195	192	
2003	26	1,327	6	362		278	96	
2004	21	975	12	494		478	58	
2005	52	964	1	462		494	62	
2006	118	1,210	3		681	192	73	
2007	40	1,185	2	913	3	343	137	
2008	75	867		880		1,616	65	
2009	208	1,275		1,005		1,372	47	
2010	16	1,661		957		186	56	
2011	66	992		63		717	7	
2012	121	980		30		214		

Table 4. Number of king mackerel sampled for length and percentage of those lengths sampled for age per year and state collected by State TIP samplers.

	AL		FL		GA		LA		MS		NC		SC		TX	
1983							3,821	0%			20	0%				
1984			4,909	0%			16,982	0%			554	0%	777	0%		
1985			6,083	0%			5,808	0%			1,066	0%				
1986			4,441	0%	90	0%	649	13%			1,471	0%				
1987			331	0%			2,238	2%			1,130	0%				
1988			48	0%			426	0%			824	0%				
1989			1	0%			1,389	0%			835	0%				
1990			17	0%			271	0%			1,511	0%			4	0%
1991			189	0%			1,789	5%	3	0%	1,266	13%	320	0%		
1992			182	3%			2,323	4%	3	0%	810	10%	563	0%		
1993			371	47%			849	78%			471	44%	586	0%		
1994			709	0%			1,167	17%			275	22%	169	0%		
1995			572	0%	63	0%	621	17%			227	0%	385	0%		
1996			1,298	0%	14	0%	331	17%			346	0%	469	0%		
1997			589	0%	15	0%	370	0%			141	0%	552	0%		
1998			1,702	0%	14	0%	38	0%			239	0%	437	0%		
1999			1,020	0%	23	0%		0%			714	0%	635	0%		
2000			1,250	0%	18	0%	58	0%			1,170	0%	853	0%		
2001			1,162	0%	23	0%	6	0%			740	0%	633	0%		
2002	1	0%	951	4%	5	0%	299	0%			195	0%	192	0%		
2003	26	0%	1,327	1%	6	0%	362	0%			278	0%	96	0%		
2004	21	0%	975	0%	12	0%	494	0%			478	6%	58	0%		
2005	52	0%	964	5%	1	0%	462	100%			494	0%	62	6%		
2006	118	0%	1,210	1%	3	0%		0%	681	0%	192	0%	73	52%		
2007	40	0%	1,185	1%	2	0%	913	100%	3	0%	343	0%	137	42%		
2008	75	0%	867	3%			880	100%			1,616	0%	65	54%		
2009	208	0%	1,275	7%			1,005	100%			1,372	0%	47	49%		
2010	16	0%	1,661	4%			957	100%			186	0%	56	98%		
2011	66	0%	992	6%			63	0%			717	0%	7	100%		
2012	121	0%	980	2%			30	0%			214	0%				