# Tracking Economic Performance Indicators for Small Boat Fisheries in American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands

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## Executive Summary

This report presents trends in economic performance indicators for small boat fisheries in American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI) from 2009 to 2017. The primary data sources of the economic performance indicators were collected through the Pacific Islands Fisheries Science Center (PIFSC) economic data collection programs' add-on to the boat-based creel surveys, implemented through collaborative efforts of the PIFSC Ocean Synthesis and Human Dimensions Program, the Western Pacific Fisheries Information Network (WPacFIN), and local fisheries agencies in the three island areas that regularly collect fishing catch and effort data through creel surveys. We established the trip-level cost data collection programs in collaboration with existing data collection vehicles that were already gathering fisheries-related data on a continuous basis. The trip cost survey is an add-on to the boat-based creel survey with a voluntary, in-person intercept interview, following the same sampling methodology as the creel survey.

The response rates to the trip cost survey varied by island area. In American Samoa, the response rate was 78% with a total of 1,294 trip cost surveys completed from August 2009 to December 2017. In Guam, the trip cost survey response rate was 39% with 1,191 trip cost surveys completed from September 2011 to December 2017. In the CNMI, the response rate was 75% with 943 trip cost surveys completed from April 2009 to December 2017.

This report includes an analysis of fishing trip costs for each of the island areas by year, gear type, and sub-fishery (pelagic, bottomfish, and reef-fish fisheries). Trip costs included the non-labor operating costs, including fuel, ice, bait and chum, and gear resupply. The average trip cost (adjusted for inflation for all gear types) was $87 in 2009 and $103 in 2017 in American Samoa, $110 in 2011 and $92 in 2017 in Guam, and $56 in 2009 and $72 in 2017 in the CNMI. Fuel costs constituted a dominant portion of total trip costs across all three areas. Fuel costs comprised about 50% or more of total trip costs in American Samoa and Guam, and over 85% in the CNMI. In American Samoa, there was a notable increase in fuel use in our time series following the introduction of a gas subsidy program by the local government in 2014. The trip cost surveys covered diverse gear types in the fisheries in each island area. Trip costs varied across gear types as well as by island areas; therefore, this report provides the trip costs by gear type and year.

In addition to trip costs, this report also generates the potential sales value per trip based on the estimated weight of trip landings (from number and length of fish caught by species in the creel survey), intended catch disposition collected in the creel surveys, and the fish species prices collected by the local fisheries agencies. Since there are no official records documenting the amount of catch sold in the three island areas at an individual trip level, data on the actual revenue associated with each trip are unavailable. The best available information related to fish sales per trip over the time series is captured in the creel surveys as "intended" disposition of catch, which can be different from the "actual" disposition because the creel survey intercepted fishermen before the fish sales actually occurred, and depending on the market conditions, fishermen might not be able to sell all the fish they wanted to sell. This study shows that 66% of the catch in CNMI was intended for sale in 2011, while Hospital and Beavers (2014) found 38% of the catch was "actually" sold. On the other hand, the potential sales value and actual fish sales in Guam are expected to be comparable given the better market condition. This study finds that 38% of the catch in Guam was intended for sale in 2011, which is comparable with Hospital and

Beavers (2012)'s finding that 35% of the catch was sold by Guam small boat fishermen. In American Samoa, 97% of the catch was intended for sale. However, unlike the other two areas, we did not find any reports on the actual percentage of catch sold for the small boat fishery in American Samoa. Whether potential sales value is a good approximation of the actual sales revenue largely depends on market conditions and other factors that affect fishermen's ability to sell (e.g., fish size, consumer demand, and species composition of catch). Therefore, care should be taken when interpreting the potential sales value. With no information available to verify the actual fish sales per trip, the best estimate we are able to derive is the "potential sales value," and it can be viewed as a proxy for the actual sales value per trip.

We also calculated the potential net revenue per trip, which is estimated as potential sales value minus trip costs. The small boat fisheries in the three island areas conduct commercial and non-commercial fishing. Non-commercial fishing could be motivated by subsistence, cultural, or recreational interests; however, there are diverse motivations for fisheries in this Pacific Islands region (Hospital and Beavers, 2012; 2014). Depending on the fishing motivation, net revenue could affect fishing effort (participation in the fishery). Therefore, the potential net revenue could be an important indicator of the dynamics of short-term fishing effort and long-term fishing industry development. It can also be used to examine short-term economic impacts on fisheries from conservation and management measures.

The average potential sales value in American Samoa was the highest at $794 per trip in 2010 and declined to $349 per trip in 2017, and trip costs were around $100 or less for all years. Thus, small boat fishermen in American Samoa would have positive potential net revenue in all years if the potential sales actually occurred. In Guam, the average potential sales value varied across years, as it was $92 in 2011, increased to $176 in 2015, and then declined to $117 in 2017. With trip costs of around $100, fishermen in the Guam small boat fishery had negative potential net revenue in 2011 and 2016. In the CNMI, the average potential sales value ranged from the lowest at $117 in 2009 to $200–300 between 2012 and 2017, and with trip costs under $90, fishermen in the CNMI had positive potential net revenue for all years of the study period.

The small boat fishery in each of the island areas can be classified into three sub-fisheries–pelagic, bottomfish, and reef fish with different gear types used in each sub-fishery. Some sub-fisheries (such as the bottomfish fishery) only use a single gear type while others may use multiple gears. Economic performance varies substantially by sub-fishery due to different average catch per trip, intended disposition, and fish prices for each species. For example, the American Samoa bottomfish fishery had the lowest potential sales value and potential net revenue in all years due to low catch and high trip costs, whereas the American Samoa pelagic and reef-fish fisheries had higher potential sales value and potential net revenue per trip in some years depending on the average catch per trip for the year. The Guam bottomfish fishery made almost nothing in terms of potential sales value, because almost none of the catch was intended for sale but kept for home consumption and given away to friends and relatives. The Guam pelagic fishery had the highest potential sales value but similar potential net revenue to reef-fish fishery, as the reef-fish fishery had the lowest trip costs. On the other hand, the CNMI reef-fish fishery had the lowest potential net revenue due to low catch.

Through the continuous economic data collection programs, we were not only able to track the trends of cost and potential net revenue but also the components that contributed to the variations

in trip costs over time. The economic data and analysis presented in this report are useful to keep fisheries managers informed on the trends of the economic performance of the small boat fisheries and for them to conduct the economic impact analysis on the changes in fisheries management and policies. It can also be useful in the case of a proposed policy affecting a particular fishing gear or sub-fishery (e.g., the restriction of SCUBA spearfishing, or an annual catch limit for a bottomfish fishery), thus enabling fisheries management to minimize the adverse economic impacts on those fishery participants to the extent possible.

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## Introduction

This report describes the continuous economic data collection programs established by the Pacific Islands Fisheries Science Center (PIFSC) for the small boat fisheries in American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI), and presents trends in economic performance indicators for these fisheries. This information was derived from analyses of the data collected through these programs from 2009 (American Samoa and the CNMI) and 2011 (Guam) to 2017. These data collection programs fulfill the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requirements that conservation and management measures shall take into account the importance of fishery resources to fishing communities by utilizing economic data (16 U.S.C. 1851(a)(8)). These data collection programs are therefore vital to providing fundamental economic information for the management of fisheries in these areas.

The small boat fisheries in American Samoa, Guam, and CNMI are one- to two-day fisheries that target pelagic and nearshore species. In Guam and CNMI, the small boat fisheries are the primary fisheries in the region while in American Samoa, there are also large-scale fisheries such as longline and purse seine. However, the longliners and purse seiners in American Samoa land the majority of their catch at the local canneries and their products are in frozen form, while small boat fishermen in all three areas land fresh fish at the local markets or keep for home consumption. These fisheries are important to the local communities, providing a source of fresh food and basic income and are an integral part of the islands' traditional and modern cultures. In 2017, the small boat fisheries provided approximately 8 pounds of fresh fish per capita in the CNMI, 5 pounds per capita in Guam, and 2 pounds per capita in American Samoa (WPRFMC 2018a, 2018b, 2018c).

The fleets typically engage in a combination of commercial and non-commercial fishing. Different external factors have influenced fishery operations. Notably, the establishment of the Marianas Trench Marine National Monument has increased local and international interest in economic aspects of the fleets, as the proclamation establishing the monument includes rules that have closed the area to commercial fishing. U.S. military exercises in an area south and southeast of Guam starting in early 2010 have limited fishing access and decreased the number of fishing days in that area. Given the importance of the small boat fishery in each of these island area communities and economies, continuous trip cost data collection programs are critical to monitor changes among these key economic indicators, especially for the commercial aspect of the fisheries.

Fisheries in the U.S. Exclusive Economic Zone (3 to 200 miles from shore for Guam and American Samoa and 0 to 200 miles around CNMI) are federally managed by the Western Pacific Regional Fishery Management Council (WPRFMC) and the territorial governments under the Mariana Archipelago Fishery Ecosystem Plan for Guam and CNMI, the American Samoa Fishery Ecosystem Plan, and the Pacific Pelagics Fishery Ecosystem Plan for American Samoa. Federal fishery regulations are enforced in partnership with the local governments. Fisheries from the shoreline out to 3 miles in American Samoa and Guam are managed by the territorial governments. Before these economic data collection programs were established, most of the economic information in these island areas was limited to dockside revenue data. Throughout the years, there have been episodic socioeconomic surveys that collected trip-level

and annual fishing expenditures (Hospital and Beavers 2012, 2014; Miller 2001; Kasaoka 1989), but there is great value in maintaining a continuous time series, as it provides more timely information that would allow managers to be more responsive in future management scenarios.

These data collection programs describe the main items of non-labor fishing trip expenses, including gallons of fuel used and fuel price, cost of ice used, cost of bait and chum used, and cost of fishing gear lost. The economic data collected can be used to: 1) satisfy regulatory objectives and analytical requirements; 2) measure the economic importance of small boat fishing to local economies and the value of fisheries to the culture and lifestyle of local communities; 3) assess the economic viability and stability of the fisheries; and 4) assist the WPRFMC in selecting policies that meet conservation and management goals while minimizing to the extent practicable any adverse economic impacts to the fisheries participants.

The survey represents a significant survey effort, combining trip cost add-on questions with the regular boat-based creel surveys conducted by the fisheries agencies of American Samoa, Guam and the CNMI. The creel survey design was assisted by Western Pacific Fisheries Information Network (WPacFIN) and survey administration by local fisheries agencies including the American Samoa Department of Marine and Wildlife Resources (DMWR), the Guam Department of Agriculture's Division of Aquatic and Wildlife Resources (DAWR), and the CNMI Department of Lands and Natural Resources' Division of Fish & Wildlife (DFW). The trip cost add-on question design and compilation was funded by the NOAA Fisheries Office of Science and Technology.

# Materials and Methods

## Population

Fishermen who engage in small boat fishing in American Samoa, Guam, and the CNMI are considered the study population. However, the actual population of fishing participants in these three island areas is difficult to gauge because there are no limited licensing requirements and no definitive reporting systems for small boat fishing participation in these areas. The most relevant estimations of the active vessels and fishermen are made by WPacFIN from boat-based creel survey programs administered by the local fisheries agencies. The potential respondent universe, approximated from WPacFIN's estimates, can be defined as (1) the number of unique small fishing boats or fishermen and (2) the number of fishing trips on an annual basis. The number of fishing trips is estimated from the boat-based creel surveys using the effort expansion systems developed by WPacFIN [creel survey expansion methodologies detailed in Hamm and Quach (1988)]. Tables 1 to 3 show the estimated number of small fishing boats or fishermen and number of trips in the three island areas from 2009 to 2017. Note that there is no estimate of the total number of unique fishing boats in each island area; however, as most of the boats used for reef-fish fishing were also used for pelagic and bottomfish fishing in these areas, and bottomfish fishing boats were usually used for trolling, the number of boats that landed pelagic species by trolling could be a rough estimation of total active small boats.

**Table 1. Estimated total number of small fishing boats and trips in American Samoa, 2009–2017**

| Year | Number of boats landing pelagic species by trolling[1] | Number of troll trips[1] | Number of bottomfish trips[2] |
|---|---|---|---|
| 2009 | 10 | 81 | 622 |
| 2010 | 7 | 53 | 251 |
| 2011 | 10 | 141 | 265 |
| 2012 | 9 | 84 | 264 |
| 2013 | 13 | 132 | 413 |
| 2014 | 22 | 157 | 401 |
| 2015 | 11 | 167 | 469 |
| 2016 | 12 | 128 | 400 |
| 2017 | 8 | 179 | 406 |

[1] WPRFMC 2018a
[2] WPRFMC 2018b

**Table 2. Estimated total number of small fishing boats and trips in Guam, 2009–2017**

| Year | Number of boats landing pelagic species by trolling[1] | Number of troll trips (non-charter)[1] | Number of bottomfish trips[2] |
|---|---|---|---|
| 2009 | 368 | 9,955 | 1,110 |
| 2010 | 432 | 9,955 | 1,316 |
| 2011 | 454 | 7,240 | 836 |
| 2012 | 351 | 4,241 | 767 |
| 2013 | 496 | 7,182 | 741 |
| 2014 | 447 | 8,495 | 702 |
| 2015 | 372 | 8,000 | 598 |
| 2016 | 408 | 10,000 | 783 |
| 2017 | 318 | 9,100 | 849 |

1 WPRFMC 2018a
2 WPRFMC 2018c

**Table 3. Estimated total number of small boat fishermen and trips in the CNMI, 2009–2017**

| Year | Number of fishermen landing pelagic species by trolling[1] | Number of troll trips (non-charter)[1] | Number of bottomfish trips[2] |
|---|---|---|---|
| 2009 | 50 | 3,533 | 587 |
| 2010 | 40 | 4,154 | 421 |
| 2011 | 48 | 3,064 | 452 |
| 2012 | 35 | 3,238 | 320 |
| 2013 | 28 | 2,434 | 292 |
| 2014 | 21 | 3,541 | 211 |
| 2015 | 12 | 2,654 | 173 |
| 2016 | 63 | 3,584 | 113 |
| 2017 | 31 | 2,599 | 88 |

1 WPRFMC 2018a
2 WPRFMC 2018c

## Methodology

The trip cost survey is an addition to the boat-based creel surveys that have existed since 1981.[1] The boat-based creel surveys were designed to collect fisheries-dependent data such as catch and effort in the three island areas. The creel surveys collect data through a voluntary, in-person intercept interview methodology. Sampling methodology is documented in Oram et al. (2011a, 2011b, 2011c). A copy of the trip cost survey questionnaire (collected under OMB Control No. 0648-0635) embedded in the creel survey form for the three areas is provided in Appendix A.

The boat-based creel survey programs were initiated in the early 1980s by the local fisheries agencies in American Samoa, Guam, and the CNMI. The participating local fisheries agencies include the American Samoa DMWR, the Guam DAWR, and the CNMI Department of Lands and Natural Resources' DFW. These agencies partner with WPacFIN for technical support, while the PIFSC Ocean Synthesis and Human Dimensions Program is responsible for the trip cost survey form design and data quality control. Through cross-agency collaboration, we built

[1] https://www.pifsc.noaa.gov/wpacfin/

the trip-level economic data collection programs onto the existing data collection vehicles that were already routinely administered.

The original boat-based creel survey included two components: (1) a participation count and (2) an access point survey. The access point survey logs all boats departing and returning during the survey period and intercepts fishermen at the boat ramp/port areas after their fishing trip, gathering the catch and effort information, species composition, and intended catch disposition. These data can be expanded to estimate total landings by gear type for the three island areas. The trip cost survey is conducted in addition to the access point survey, and transcribed by local fisheries staff from the interview forms to the electronic database that was developed and managed by WPacFIN. Periodically, the PIFSC Ocean Synthesis and Human Dimensions Program obtains the trip cost data and creel survey data, and uses the Statistical Package for the Social Sciences (SPSS) to process the data for further data cleaning, processing, and analysis. The metadata for this report is available at https://inport.nmfs.noaa.gov/inport/item/20627.

The sampling frame of the creel survey was developed by WPacFIN. Interviews are conducted 6 to 14 times per month using a systematic random sampling protocol at sites (ramps/docks) that are actively used for launching small fishing boats throughout the year. Sample dates are drawn for year-round monthly sampling. Each selected sample date contains of two shifts, morning (AM) and evening (PM). The data collection efforts are organized and carried out by the local fisheries agencies. Interviews are conducted during the shift time by trained fisheries staff at the scheduled site when fishermen return from their fishing trips. Boats are chosen on a first-come-first-served basis for interviews, with the priority being to collect boat log data first and interviews second. When too many boats return at the same time and cannot all be interviewed, staff prioritize interviews for boats fishing with the gear types least encountered over the past month. Since the trip cost survey is an 'add-on' portion to the access point survey, the sampling methodology is the same. Details of the survey locations, minimum survey days, and shift times are given in Appendix B.

Throughout the report, any summarized data that are based on fewer than three unique boats are not presented due to confidentiality requirements. Also, all longitudinal data are inflation-adjusted to the most current year in the sample period (i.e., 2017). Appendix C gives the Consumer Price Index (CPI) for the three island areas.

Table 4 lists details the starting years of the economic data collection programs and the data collection periods covered in this report.

**Table 4. Summary of continuous economic data collection programs**

| Fishery | Year program started | Data period in this report |
|---|---|---|
| American Samoa small boat fishery | 2009 | 2009–2017 |
| Guam small boat fishery | 2011 | 2011–2017 |
| CNMI small boat fishery | 2009 | 2009–2017 |

## Potential Sales Value and Potential Net Revenue Calculation

Besides trip costs, this report also calculates the potential sales value and potential net revenue of a trip. The creel survey collects the number and length of fish caught by species. WPacFIN

converts these data into landings by species in pounds. In American Samoa, the creel survey asks fishermen for their *intended* catch disposition by species (e.g., not for sale, sell to local business). To estimate the value of fish sold by species, we use the intended disposition by species, landings by species in pounds, and fish price by species collected by the local fishery agency. In American Samoa, the potential sales value of a fishing trip is calculated as follows:

$$\text{Potential Sales Value of a Fishing Trip} = \sum_{i=1}^{n} \left[ \begin{array}{c} \text{Fishing Landings for Species } i \times \\ \text{Average Annual Fish Price for Species } i \times \\ \text{Catch Intended for Sale for Species } i \end{array} \right]$$

where species *i* ranges from 1 to *n* in a trip.

In Guam and the CNMI, the potential sales value of a fishing trip is calculated slightly differently from the American Samoa potential sales value because of differences in the data fields captured in the creel surveys. The creel survey in Guam and the CNMI records the intended disposition for the whole trip, whereas the creel survey in American Samoa records the intended disposition by species caught on a trip. The potential sales value for a fishing trip in Guam and the CNMI is calculated by using the WPacFIN estimates of landings by species in pounds, the percent of catch intended for sale for each trip, and the fish price by species collected by the local fishery agency:

Potential Sales Value of a Fishing Trip =

$$\sum_{i=1}^{n} \left[ \begin{array}{c} \text{Fishing Landings for Species } i \times \\ \text{Average Annual Fish Price for Species } i \end{array} \right] \times \text{ \% of Catch Intended for Sale for a Trip}$$

where species *i* ranges from 1 to *n* in a trip.

It is important to emphasize that the sales value presented in this study is called "potential sales value" because it is an anticipated value based on possible outcome (keep or sell as reflected in intention to sell). It is neither the "estimation of sale" nor the "actual sale." Because there are no official records documented on the amount of catch sold in the three island areas at an individual trip level; therefore, data on the actual revenue associated with each trip are unavailable for the fisheries in the three island areas. The best available information related to fish sales per trip in a time series is captured in the creel survey as "intended" deposition, which may be different from the "actual" disposition because the creel survey intercepted fishermen before the fish sales actually occurred.

In reality, fishermen might not be able to sell all the fish they intended to sell in the market. A cost-earnings survey was fielded during 2011 in Guam and CNMI and asked small boat fishermen whether they were able to sell all the fish they wanted to sell. Hospital and Beavers (2014) reported that more than half (57%) of the CNMI small boat fishermen in the sample could not always sell all the fish they wanted to sell in the past 12 months, primarily due to the market conditions. However, the market condition was better in Guam, as Hospital and Beavers (2012) found that 82% of Guam small boat fishermen in the sample felt they could always sell all the

fish they wanted to. The fish were sold locally, so although two studies were fielded during the same time period, the survey results indicated that local market conditions varied by location.

For all three island areas, the potential net revenue per trip is calculated as potential sales value per trip minus trip costs:

Potential Net Revenue = Potential Sales Value of a Fishing Trip – Trip Costs.

Note: Because a small number of trips did not report catch disposition, those trips were eliminated from the potential sales value analysis. However, their fishing trip cost data were included in the trip costs analysis.

## Sub-fishery Definition

Since multiple gears are often used in sub-fisheries (e.g., pelagic fish are caught by trolling and alia longline; reef fish are caught by spear, snorkel, and gillnet), the small boat fishery in each island area can be classified into three sub-fisheries based on gear used and species caught. Table 5 summarizes the sub-fisheries. Trips that used mixed gear and caught different types of fish (e.g., a mixed troll and bottomfish trip that caught both pelagic fish and bottomfish) are not classified in any of the sub-fisheries and are omitted from the sub-fishery analysis. That is, except for trips in Guam that used mixed troll and spear/snorkel gear and caught only reef fish, which are classified in the reef-fish fishery.

**Table 5. Summary of sub-fishery definitions based on gear used and species caught**

| Fishery | Pelagic fishery | Bottomfish fishery | Reef-fish fishery |
|---|---|---|---|
| American Samoa | Troll & caught pelagic species, alia longline | Bottomfish gear | Spear, trool & caught reef fish |
| Guam | Troll & caught pelagic species | Bottomfish gear | Spear, snorkel, scuba, gillnet, atulai, troll & caught reef fish |
| CNMI | Troll & caught pelagic species | Bottomfish gear | Spear, snorkel, atulai, castnet, troll & caught reef fish |

## Response Rates

Response rates to the add-on trip cost survey were defined as the percent of non-charter boat-based creel surveys with complete trip cost data. In the following section, we present the response rates for the trip cost surveys in the small boat fisheries in the three island areas, respectively.

### *American Samoa Small Boat Fishery Sample*

During the period of August 2009 to December 2017, 1,761 creel surveys were conducted in American Samoa by American Samoa staff using the WPacFIN methodology. Among those, 24 charter trips and 73 shore fishing surveys were excluded from this analysis. The charter trips were excluded because they are associated with recreational fishing. The shore fishing surveys were excluded because they did not utilize boats. Of the 1,664 non-charter trips, 1,294 (78%) had complete trip cost data. Table 6 shows the overall response rate for the trip cost survey. The response rate to the add-on trip cost survey was highest in 2011 (96%) and lowest in 2012 (36%).

Table 7 shows the response rates for the trip cost survey by year. In 2012 and 2013, the number of incomplete trip cost surveys was especially high because an older version of the survey form was used and it did not include the fuel use question. Since the issue was corrected, the number of completed surveys has improved greatly.

**Table 6. Response rate for the trip cost survey of the American Samoa small boat fishery, sample period: August 2009 to December 2017**

| Economic Forms (Non-charter boat trips) | Number | Percent |
|---|---|---|
| Completed | 1,294 | 78 |
| Incomplete | 179 | 11 |
| Blank | 191 | 11 |
| **Total** | **1,664** | **100** |

Data source: Trip cost survey add-on to the boat-based creel survey of the American Samoa DMWR.

**Table 7. Annual response rate for the trip cost survey of the American Samoa small boat fishery**

| | Number of non-charter trips | Number of completed surveys | Number of incomplete surveys | Number of blank surveys | Percent of completed surveys |
|---|---|---|---|---|---|
| 2009 (Aug-Dec) | 22 | 15 | 1 | 6 | 68 |
| 2010 | 101 | 79 | 1 | 21 | 78 |
| 2011 | 165 | 158 | 0 | 7 | 96 |
| 2012 | 144 | 52 | 67 | 25 | 36 |
| 2013 | 234 | 130 | 70 | 34 | 56 |
| 2014 | 371 | 317 | 5 | 49 | 85 |
| 2015 | 267 | 239 | 8 | 20 | 90 |
| 2016 | 203 | 177 | 17 | 9 | 87 |
| 2017 | 157 | 127 | 10 | 20 | 81 |
| **Total** | **1,664** | **1,294** | **179** | **191** | **78** |

Data source: Trip cost survey add-on to the boat-based creel survey of the American Samoa DMWR.

### *Guam Small Boat Fishery Sample*

During the periods of September 2011 to April 2012, and January 2013 to December 2017, 3,595 creel surveys were completed in Guam. Among those, 541 were for charter trips and 3,054 were for non-charter trips. Among the 3,054 non-charter trips, 1,191 (39%) had complete trip cost data. Table 8 shows the response rate for the trip cost survey. Among the non-charter trips, the response rate was highest in 2011 (71%) and lowest in 2016 (19%). Table 9 shows the response rate for the trip cost survey by year. Response rate in Guam is the lowest when compared with the response rates in American Samoa and CNMI. WPacFIN staff member Michael Quach, who has had extensive field experience in these islands fisheries, explained that fishermen in Guam are more reluctant to respond to surveys (personal communication, November 29, 2017).

**Table 8. Response rate for the trip cost survey of the Guam small boat fishery, sample period: September 2011 to December 2017**

| Economic Forms (Non-charter boat trips) | Number | Percent |
|---|---|---|
| Completed | 1,191 | 39 |
| Incomplete | 50 | 2 |
| Blank | 1,813 | 59 |
| **Total** | **3,054** | **100** |

Data source: Trip cost survey add-on to the boat-based creel survey of the Guam DAWR.

**Table 9. Annual response rate for the trip cost survey of the Guam small boat fishery**

| | Number of non-charter trips | Number of completed surveys | Number of incomplete surveys | Number of blank surveys | Percent of completed surveys |
|---|---|---|---|---|---|
| 2011 (Sep-Dec) | 153 | 109 | 9 | 35 | 71 |
| 2012 (Jan-Apr) | 111 | 70 | 10 | 31 | 63 |
| 2013 | 428 | 275 | 3 | 150 | 64 |
| 2014 | 479 | 189 | 15 | 275 | 39 |
| 2015 | 502 | 233 | 8 | 261 | 46 |
| 2016 | 729 | 138 | 2 | 589 | 19 |
| 2017 | 652 | 177 | 3 | 472 | 27 |
| **Total** | **3,054** | **1,191** | **50** | **1,813** | **39** |

Data source: Trip cost survey add-on to the boat-based creel survey of the Guam DAWR.

### *CNMI Small Boat Fishery Sample*

During the period of April 2009 to December 2017, 1,398 creel surveys were completed in the CNMI. Among those, 137 were for charter trips and 1,261 were for non-charter trips. Among the 1,261 non-charter trip observations, 943 (75%) had complete trip cost data. Table 10 shows the overall response rate for the trip cost survey. Among the non-charter trips, the response rate was highest in 2014 (98%) and lowest in 2017 (50%). Table 11 shows the response rate for the trip cost survey by year.

**Table 10. Response rate for the trip cost survey of the CNMI small boat fishery, sample period: April 2009 to December 2017**

| Economic Forms (Non-charter boat trips) | Number | Percent |
|---|---|---|
| Completed | 943 | 75 |
| Incomplete | 34 | 3 |
| Blank | 284 | 22 |
| **Total** | **1,261** | **100** |

Data source: Trip cost survey add-on to the boat-based creel survey of the CNMI DFW.

**Table 11. Annual response rate for the trip cost survey of the CNMI small boat fishery**

| | Number of non-charter trips | Number of completed surveys | Number of incomplete surveys | Number of blank surveys | Percent of completed surveys |
|---|---|---|---|---|---|
| 2009 (Apr-Dec) | 120 | 72 | 7 | 41 | 60 |
| 2010 | 148 | 87 | 5 | 56 | 59 |
| 2011 | 142 | 104 | 9 | 29 | 73 |
| 2012 | 155 | 145 | 7 | 3 | 94 |
| 2013 | 182 | 148 | 2 | 32 | 81 |
| 2014 | 160 | 157 | 1 | 2 | 98 |
| 2015 | 119 | 94 | 1 | 24 | 79 |
| 2016 | 114 | 75 | 0 | 39 | 66 |
| 2017 | 121 | 61 | 2 | 58 | 50 |
| **Total** | **1,261** | **943** | **34** | **284** | **75** |

Data source: Trip cost survey add-on to the boat-based creel survey of the CNMI DFW.

# Results

Survey responses are summarized by year and gear type. Analysis is also provided by the sub-fisheries based on the fishing gear used, since fishery management and regulations are often tied to the specific sub-fisheries, which are pelagic, bottomfish, and reef-fish fisheries.

## American Samoa Small Boat Trip Costs

### *American Samoa Trip Costs for All Gear Types*

The American Samoa average trip costs (non-labor operating) for all gear types from 2009 to 2017 are itemized in Figure 1. All values are inflation-adjusted to 2017 dollars. The annual average trip costs in American Samoa were $87 in 2009 (August to December), increased in the next 2 years, and dropped to $75 in 2012. Afterward, the average annual trip costs were around $100. Fuel was the major component of trip costs. Non-fuel costs included spending on ice, bait and chum, and gear lost.[2] The increase in trip costs from 2009 to 2011 primarily resulted from an increase in fuel costs. The cost profile in 2009 (with fuel costs lower and non-fuel costs higher) is dissimilar to all of the other years. The lowest fuel usage was in 2009 (average of 11 gallons per trip), and lowest fuel price ($3.79/gallon) between 2009 and 2013. The low fuel usage estimate may also be due to the small sample size (15 trips in 2009) and a high percentage of spearfishing trips that had relatively short trip lengths. On the other hand, the decrease in trip costs in 2012 was mainly due to lower fuel usage on average. In particular, the fuel usage per trip for both bottomfish and spearfishing trips declined in 2012 compared to 2011 and 2010. In 2013, the average trip costs reached the highest level because fuel usage returned to 2010 and 2011 averages while fuel prices were relatively high ($4.36) over the period 2009–2013. High non-fuel costs (i.e., ice) also contributed to the high trip costs in 2013. Note that ice cost was added to

[2] Ice cost was omitted in the American Samoa survey form in the first few years of data collections but was added from 8/23/2012.

the survey form starting August 23, 2012, and the average ice cost was $14 per trip in 2012 and increased to $23 per trip in 2017.

Starting in 2014, fuel usage and fuel prices reported by fishermen changed dramatically because the American Samoa government instituted a gas subsidy program that provided financial relief from the soaring fuel price to small boat fishermen. The gas subsidy program in American Samoa started in April 2014 and continued through October 2015. It was restarted in the latter part of 2016 (August 2016) and ended on April 10, 2017. During the first phase of the subsidy program, the American Samoa government provided boat owners or owner operators with a coupon for gas upon their return to dock. The coupon allowed the amount of gas that was used during the fishing trip (up to 50 gallons) to be purchased for $1.75 per gallon compared to the market price of $4.07 per gallon in 2014 and $2.81 per gallon in 2015 for unleaded gas (American Samoa Government Department of Commerce Statistics Division 2017, Table 11.4 Average retail prices of selected commodities: 2005 to 2015). Another iteration of the gas subsidy program was restarted on August 9, 2016 with some modifications in the program implementation. During this iteration, instead of getting a coupon after each trip, the boat owners or owner operators could request the discounted gas each week on Monday and Thursday. Discounted gas was provided to the fishermen if their boats were actually observed fishing during the preceding days. Therefore, each boat owner (or owner operator) can get a 50-gallon coupon at $1.75 per gallon per trip, for up to two trips per week (that is, a maximum of 100 gallons of gas per week).

Most of the fishermen took advantage of this gas subsidy program and the average fuel price per gallon paid by fishermen dropped substantially from $4.36 in 2013 to $2.30 in 2014. The average fuel use per trip increased from 17 gallons in 2013 to 30 gallons in 2014. Figure 2 shows the average fuel use and fuel price for all gear types from 2009 to 2017.

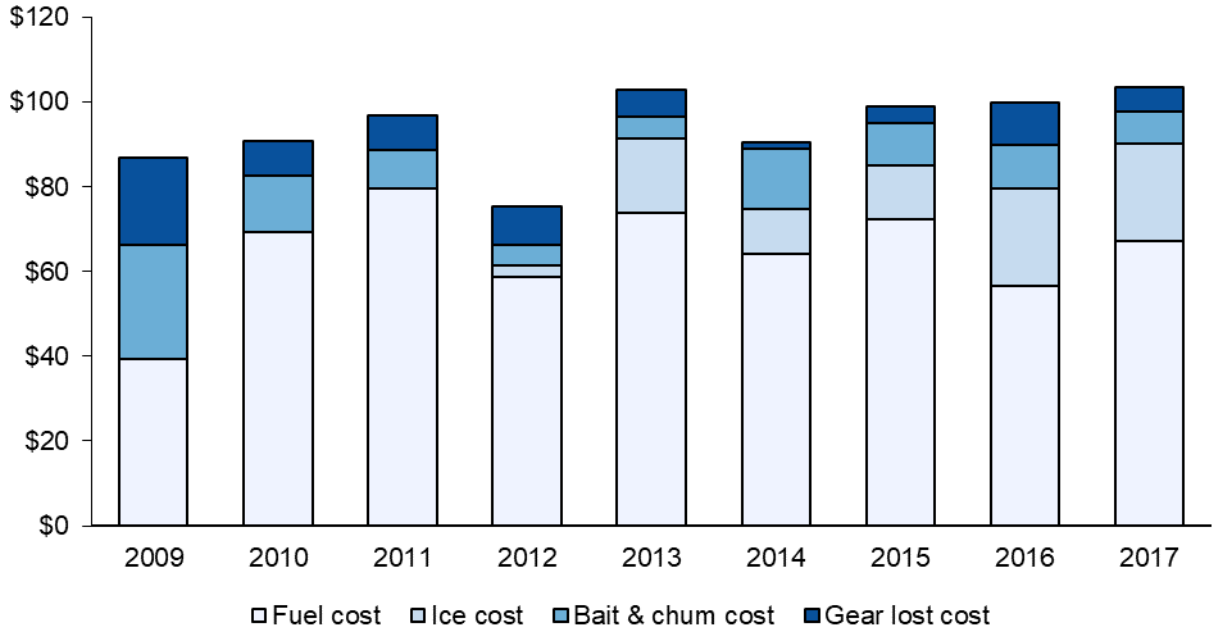

**Figure 1. Average trip costs for all gear types, American Samoa small boat fishery, 2009–2017 (adjusted to 2017 dollars)**

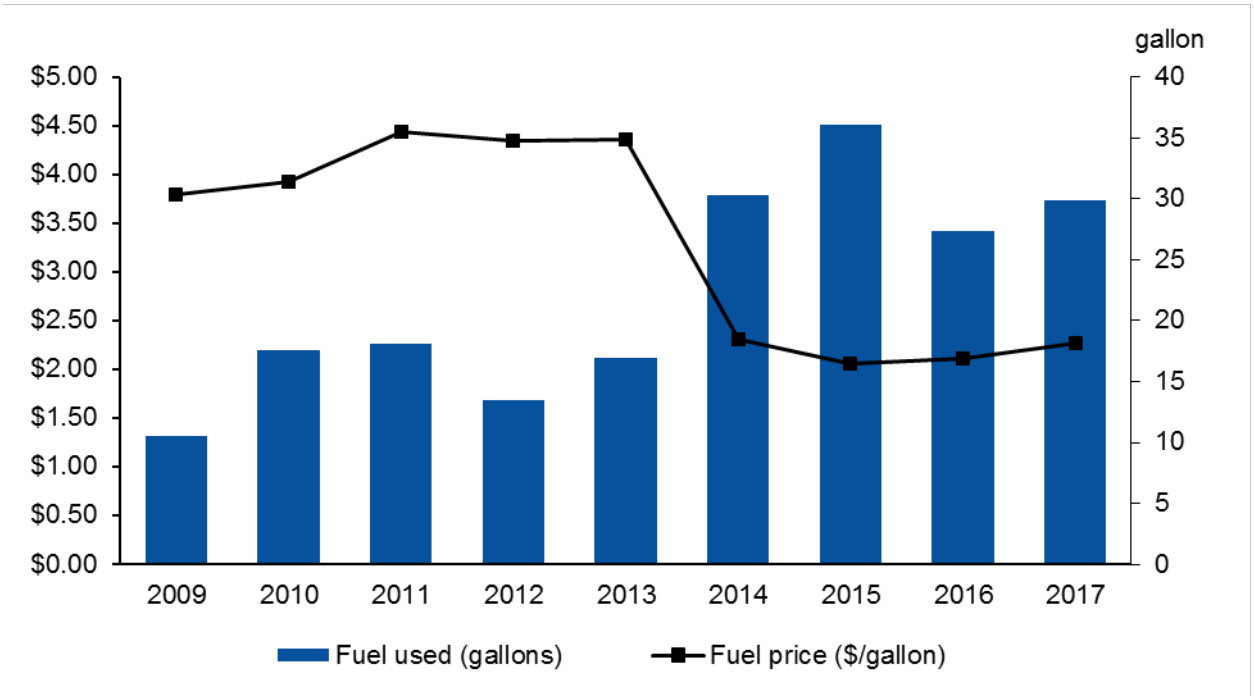


**Figure 2. Average fuel use and fuel price for all gear types, American Samoa small boat fishery, 2009–2017 (adjusted to 2017 dollars)**

### *American Samoa Trip Costs by Gear Type*

The major gears used in the American Samoa small boat fishery include bottomfish gear that targets snappers, groupers, and emperors; troll that targets tunas, skipjacks, and trevally; and spear that targets parrotfish and surgeonfish. The number of observations by gear type in the trip cost survey reflects the mix of gear in the small boat fishery. One-third of the gear types in the survey sample were bottomfish (33%), followed by spear (25%), troll (20%), mixed troll and bottomfish (11%), and alia longline (small boat longline) (11%). Table 12 shows the number of observations by gear type from August 2009 to December 2017.

**Table 12. Number of observations by gear type in American Samoa small boat fishery, sample period: August 2009 to December 2017**

| Gear Type | Number | Percent |
|---|---|---|
| Bottomfishing | 430 | 33 |
| Spear (boat-no tanks) | 318 | 25 |
| Troll | 262 | 20 |
| Mixed troll and bottomfish | 144 | 11 |
| Alia longline | 136 | 11 |
| Other | 4 | 0.3 |
| **Total** | **1,294** | **100** |

Trip costs vary by gear type. Figure 3 illustrates the trip costs by gear type in 2017. Fishermen who used bottomfish gear spent $125 per trip, whereas fishermen who used spearfishing gear spent the least at $55 per trip. Fuel costs contributed the most to troll trips (77%) and least to

bottomfish trips (58%). Figures 4 to 7 show the costs per trip by different gear types from 2009 to 2017, including bottomfish trips, spearfishing trips, troll trips, and mixed troll and bottomfish trips, respectively. Appendix Table D1 shows the total fishing trip costs by gear and year, and Appendix Table D2 shows the fishing trip costs and fuel cost share by category, gear, and year.

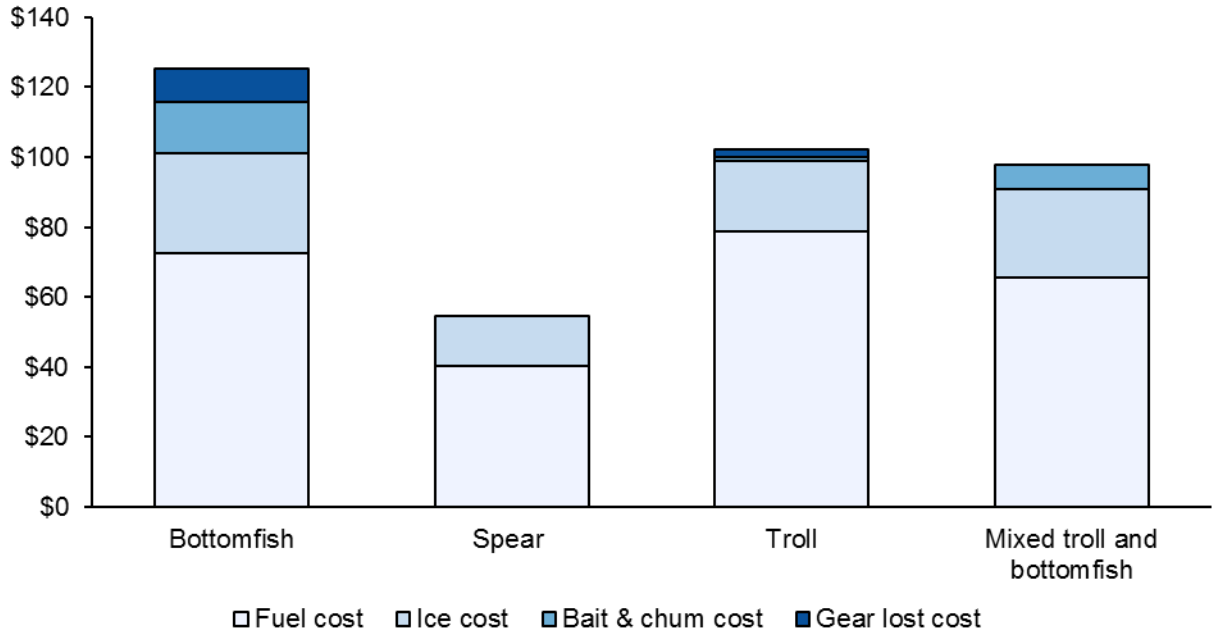


**Figure 3. Average trip costs by gear type, American Samoa small boat fishery, 2017**

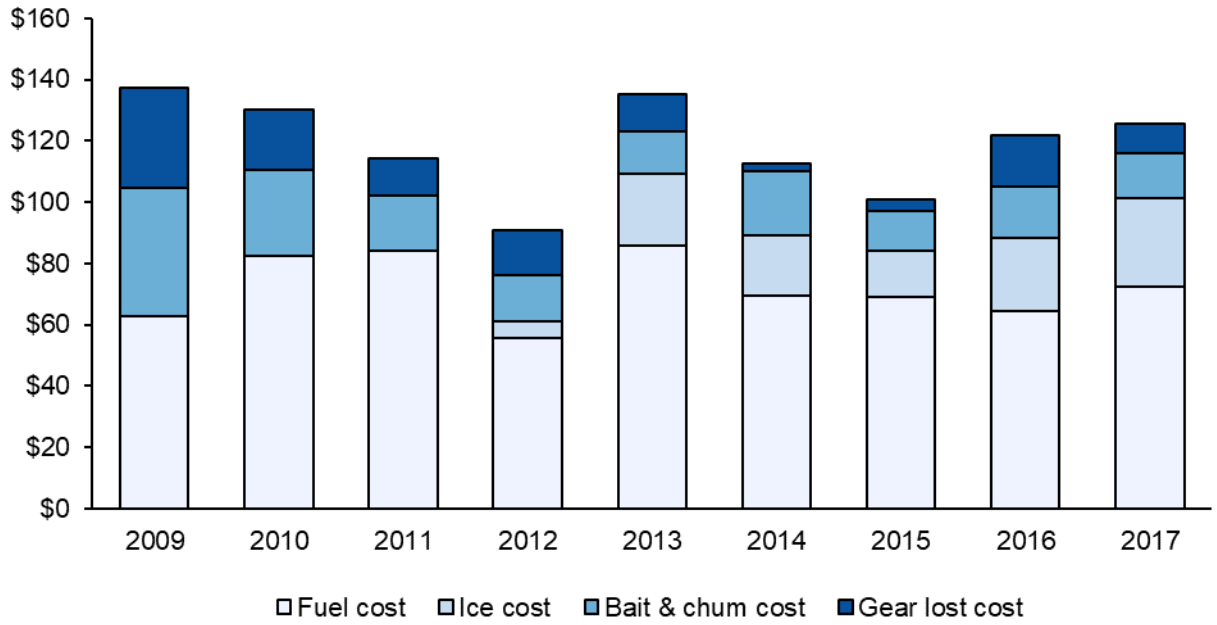


**Figure 4. Average trip costs for American Samoa bottomfish trips, 2009–2017 (adjusted to 2017 dollars)**

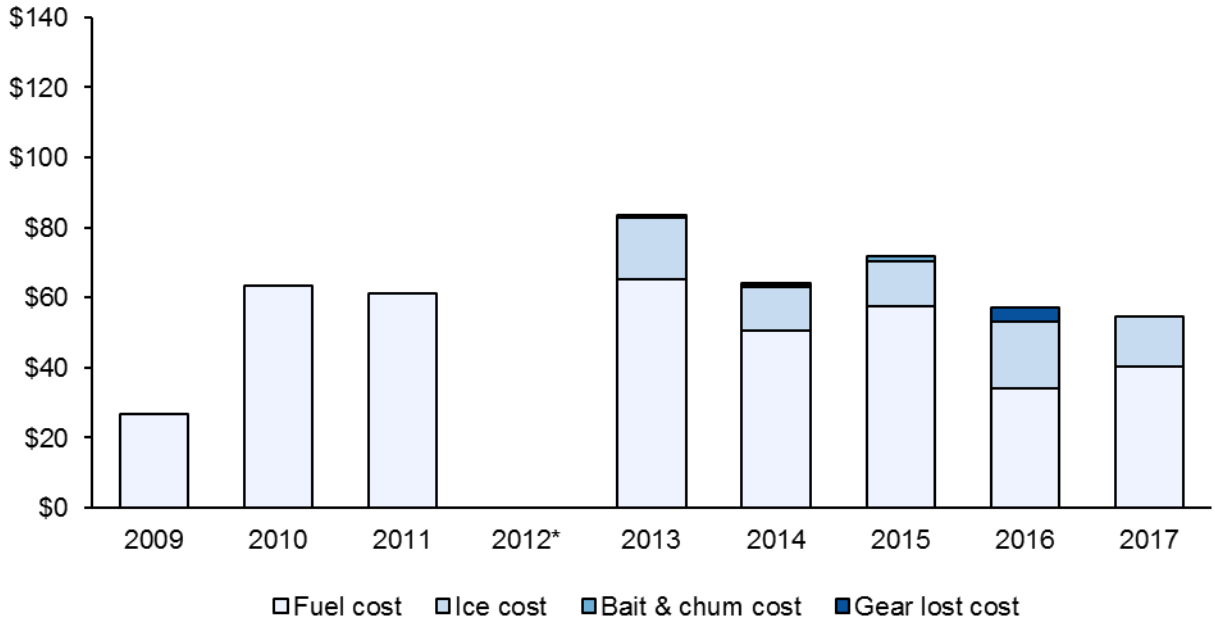


**Figure 5. Average trip costs for American Samoa spearfishing trips, 2009–2017 (adjusted to 2017 dollars)**

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

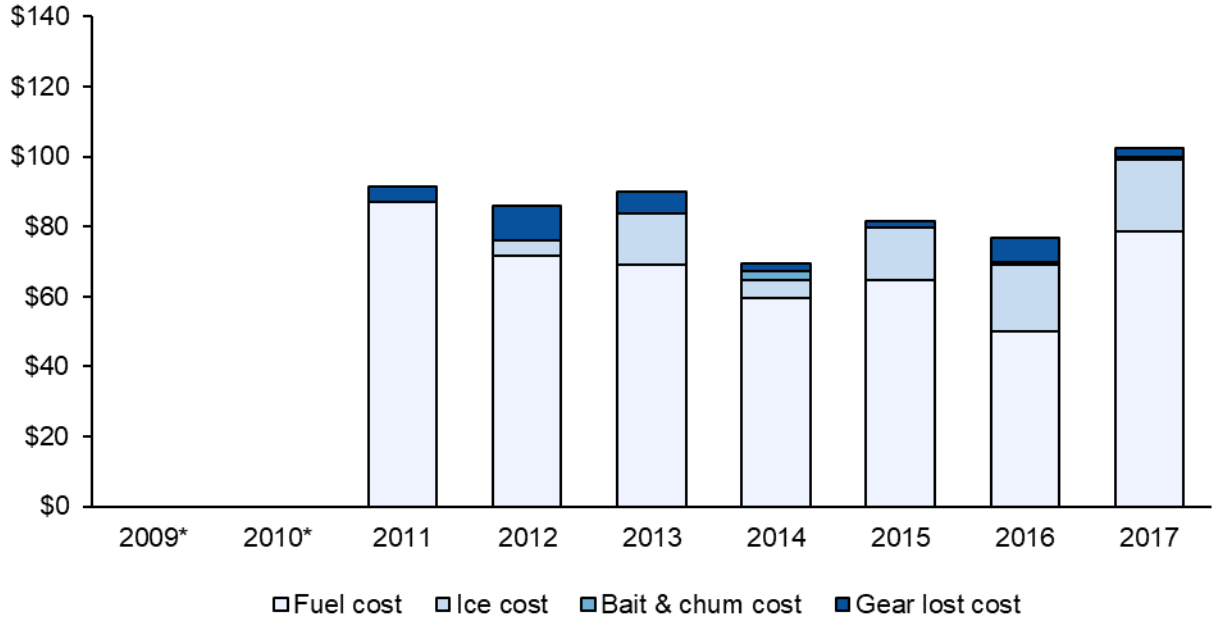


**Figure 6. Average trip costs for American Samoa troll trips, 2011–2017 (adjusted to 2017 dollars)**

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

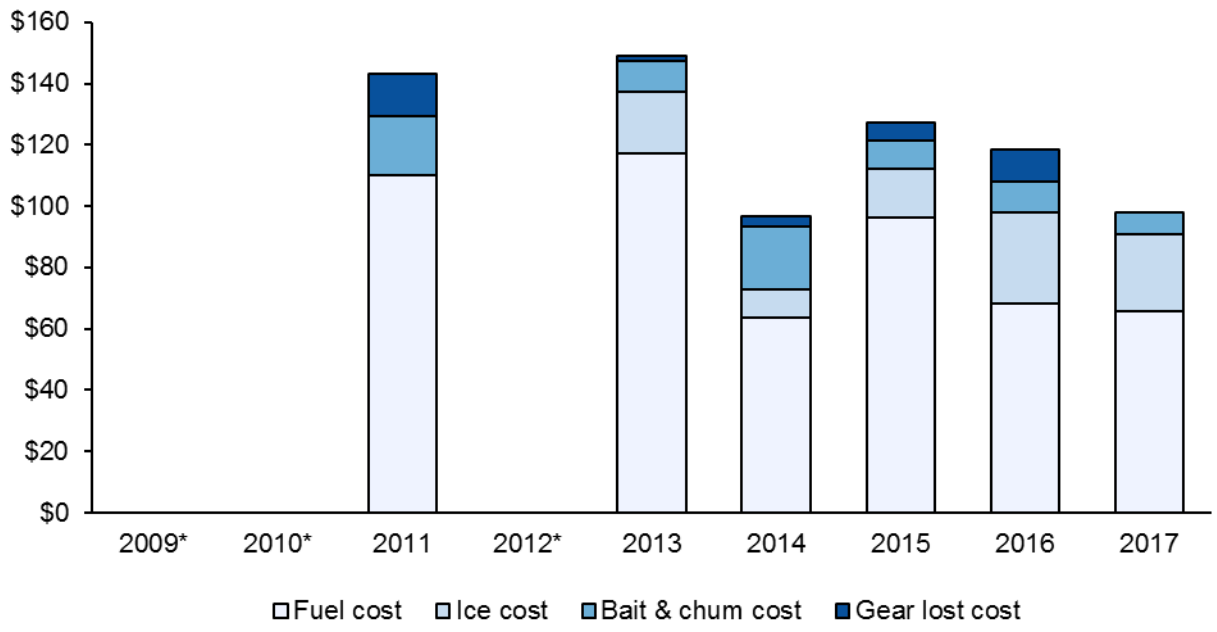


**Figure 7. Average trip costs for American Samoa mixed troll and bottomfish trips, 2009–2017 (adjusted to 2017 dollars)**

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

### *American Samoa Monthly Fuel Price*

As shown in Figures 3–7, fuel costs constituted a large portion of fishing trip costs. Fuel price per gallon had been increasing over time from $3.65 in August 2009 to around $4.50 from mid-2011 to mid-2012. With the start of the fuel subsidy program in April 2014, fuel prices paid by fishermen dropped significantly until the end of the first phase of the program in October 2015. The fuel price went back up to around $3 after October 2015, and dropped during the second phase of the program between August 2016 and April 2017. Figure 8 shows the average fuel price paid by fishermen from 2009 to 2017.

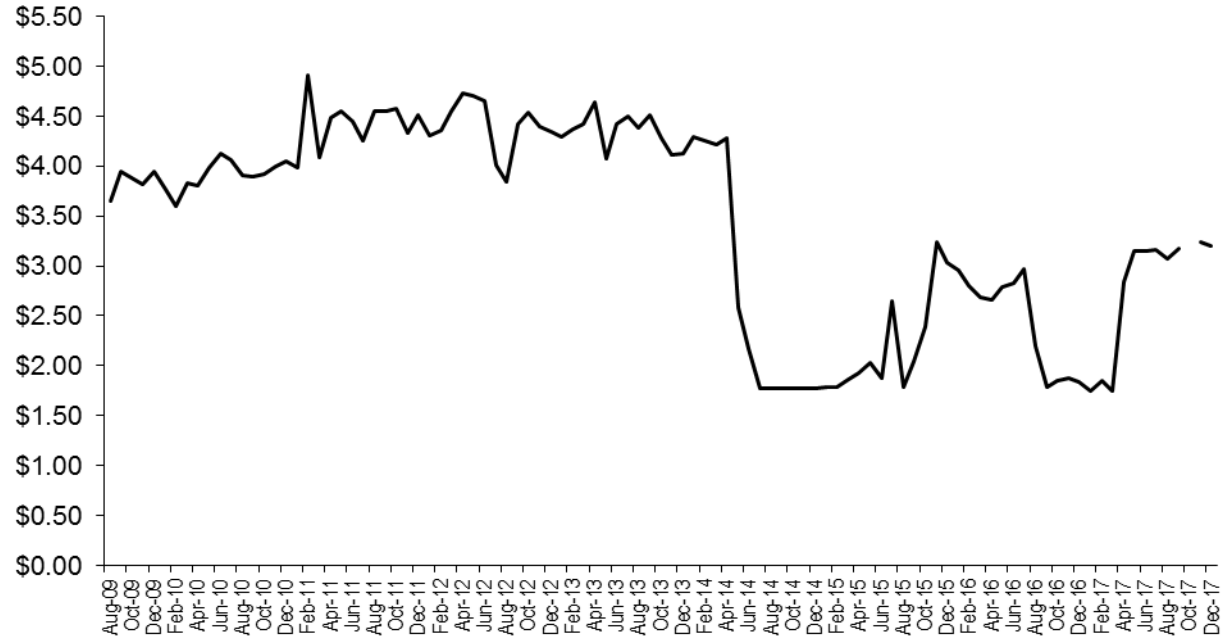


**Figure 8. Average monthly fuel price paid by fishermen, American Samoa small boat fishery, 2009–2017 (adjusted to 2017 dollars)**

## American Samoa Potential Sales Value of Fishing Trip

The average percent of catch intended for sale in American Samoa was 97% over the period 2009–2017, ranging from 78% in 2009 to 100% in 2014 and 2015. Within the period of 2009–2017, 100% of the catch from spearfishing trips and alia longline trips was intended for sale. The average percent of catch intended for sale was 98% for mixed troll and bottomfish trips, 97% for bottomfish trips, and 93% for troll trips.

The average potential sales value of fishing trips was highest in 2010 at $794 and dropped continuously until 2017, when it was $349. Figure 9 shows the average potential sales value, the average trip costs, and the respective standard errors of the means in American Samoa from 2009 to 2017. The reason for the decrease of potential sales value since 2012 was mainly due to the decrease in total catch per trip. On the other hand, average fishing hours per trip increased since 2012, with the greatest increase from 2013 to 2014, which was likely due to the implementation of the fuel subsidy program since 2014 that encouraged fishermen to take longer trips. With the opposite trends of total catch per trip versus fishing hours per trip, the catch per fishing hour showed a decreasing trend between 2012 and 2015. Figure 10 shows the average total catch per trip, fishing hours per trip, and catch per fishing hour for all gear types from 2009 to 2017. With the decreasing catch per trip since 2012, we observe two interesting related trends: the rise of the portion of catch intended for sale, and the increase in fish price per pound. It is likely that the opposite trends between catch per trip and fish price since 2012 contributed to the increase in the portion of catch intended for sale. Figure 11 shows the percent of catch intended for sale per trip and the average fish price per pound for all gear types from 2009 to 2017.

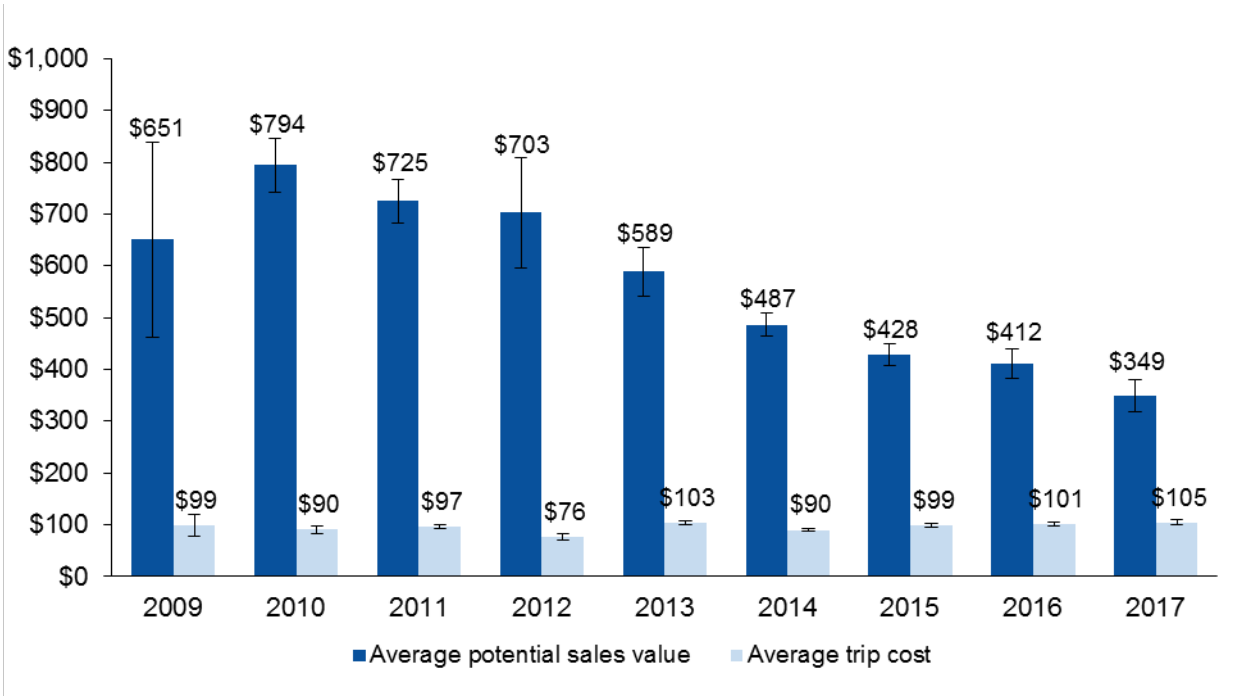


**Figure 9. Average potential sales value, average trip costs*, and standard errors (shown by blankets) for all gear types, American Samoa small boat fishery, 2009–2017 (adjusted to 2017 dollars)**

*Note: annual trip costs are slightly different from Figure 1 due to some trips with no disposition records and therefore no sales value, which were eliminated from this analysis.

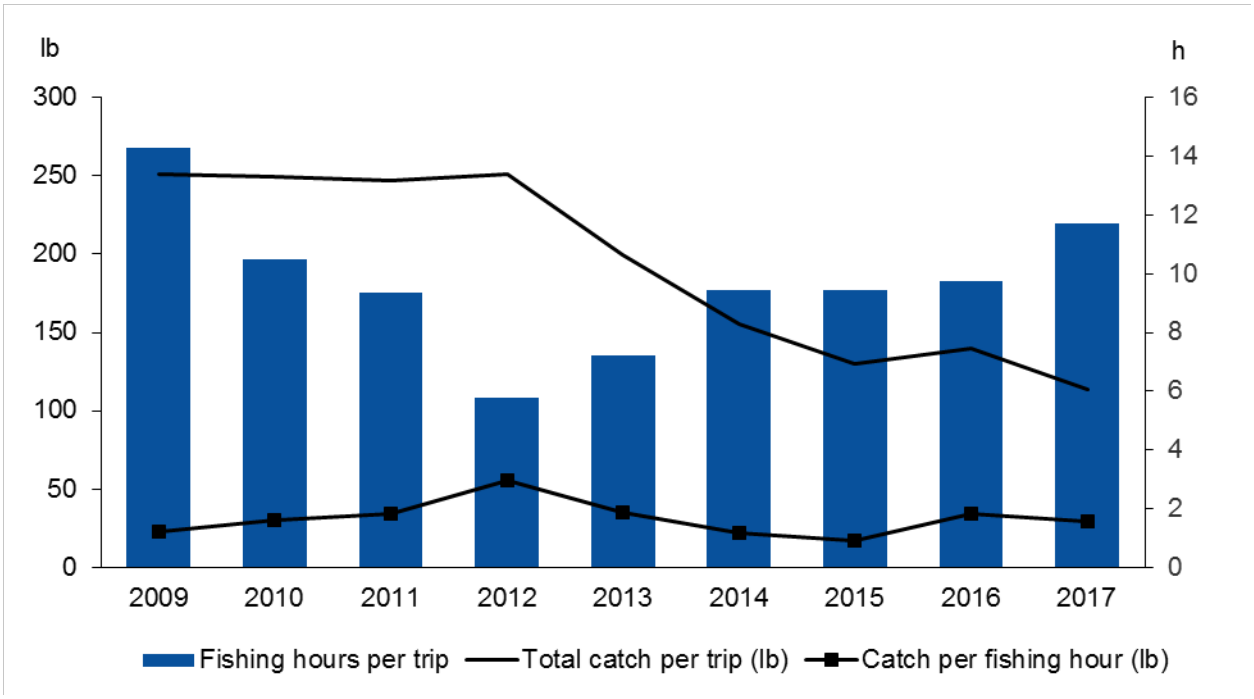


**Figure 10. Average total catch per trip, fishing hours per trip, and catch per fishing hour for all gear types, American Samoa small boat fishery, 2009–2017**

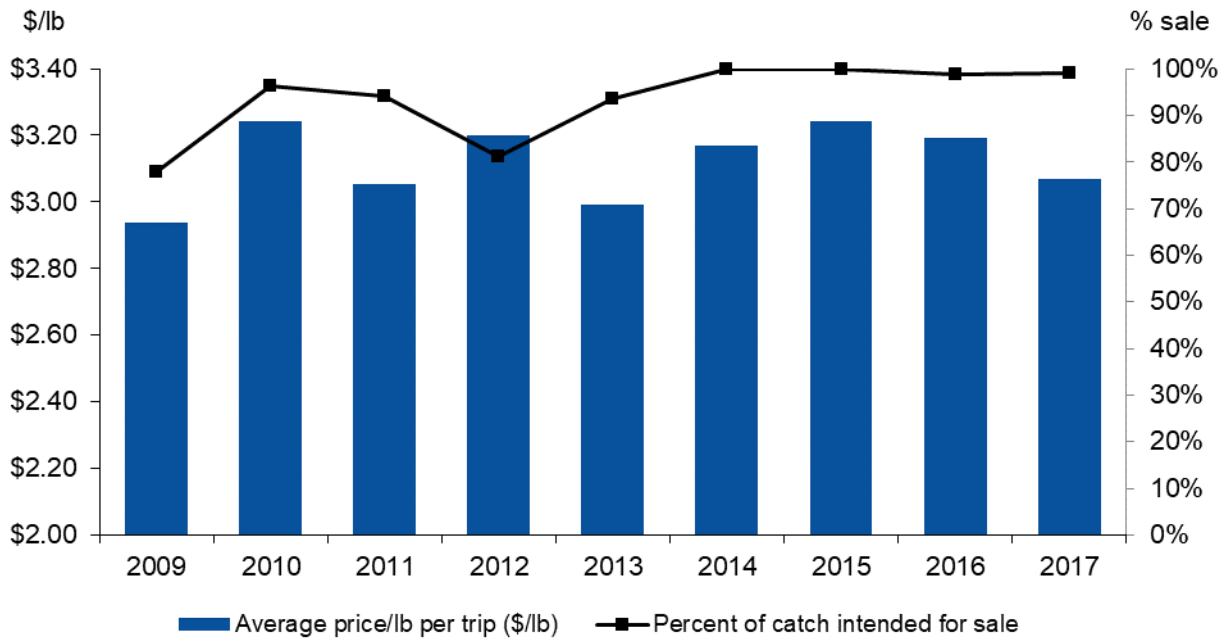


**Figure 11. Percent of catch intended for sale per trip and average fish price per pound for all gear types, American Samoa small boat fishery, 2009–2017 (adjusted to 2017 dollars)**

### *American Samoa Potential Sales Value of Fishing Trip by Gear Type*

Potential sales values and potential net revenue vary greatly by gear type in the American Samoa small boat fishery. Bottomfishing trips had lower potential sales value and potential net revenue compared with other gears due to low catch per trip and high trip costs. Spearfishing trips and troll fishing trips showed higher potential sales value and potential net revenue, but for different reasons. Spearfishing trips had lower trip costs and higher fish prices whereas troll trips had higher catch per trip. Table 13 shows the average per-trip potential sales value, potential net revenue, catch, fishing hours, and fish price per pound by gear and year.

**Table 13. Potential sales value, potential net revenue, catch, fishing hours, and fish price per pound, on average per trip and by gear and year, American Samoa small boat fishery (adjusted to 2017 dollars)**

| Gear | Year | *Number of interviews (n)* | Potential sales value ($) | Potential net revenue ($) | Catch (lb) | Fishing hours (h) | Fish price/lb ($) |
|---|---|---|---|---|---|---|---|
| Bottomfish | 2009 | 4 | 880 | 742 | 312 | 17.5 | 3.18 |
| Bottomfish | 2010 | 23 | 612 | 482 | 213 | 17.1 | 3.22 |
| Bottomfish | 2011 | 45 | 546 | 430 | 179 | 13.8 | 3.11 |
| Bottomfish | 2012 | 12 | 382 | 291 | 132 | 7.8 | 3.58 |
| Bottomfish | 2013 | 30 | 395 | 257 | 117 | 11.5 | 3.29 |
| Bottomfish | 2014 | 95 | 369 | 256 | 118 | 13.1 | 3.18 |
| Bottomfish | 2015 | 101 | 386 | 285 | 114 | 11.1 | 3.40 |
| Bottomfish | 2016 | 50 | 329 | 205 | 90 | 11.5 | 3.59 |
| Bottomfish | 2017 | 54 | 273 | 146 | 84 | 10.7 | 3.13 |
| Spear | 2009 | * | * | * | * | * | * |
| Spear | 2010 | 45 | 928 | 864 | 273 | 6.8 | 3.31 |
| Spear | 2011 | * | * | * | * | * | * |
| Spear | 2012 | * | * | * | * | * | * |
| Spear | 2013 | 46 | 839 | 756 | 254 | 5.7 | 3.33 |
| Spear | 2014 | 60 | 389 | 324 | 124 | 6.8 | 3.17 |
| Spear | 2015 | 25 | 470 | 398 | 153 | 8.6 | 3.11 |
| Spear | 2016 | 28 | 162 | 104 | 49 | 7.5 | 3.29 |
| Spear | 2017 | 22 | 176 | 122 | 55 | 14.9 | 3.19 |
| Troll | 2009 | * | * | * | * | * | * |
| Troll | 2010 | * | * | * | * | * | * |
| Troll | 2011 | 29 | 704 | 615 | 285 | 6.0 | 2.66 |
| Troll | 2012 | 16 | 947 | 863 | 377 | 4.6 | 2.60 |
| Troll | 2013 | 34 | 409 | 320 | 190 | 4.9 | 2.29 |
| Troll | 2014 | 63 | 581 | 512 | 194 | 6.2 | 3.16 |
| Troll | 2015 | 40 | 369 | 287 | 114 | 6.3 | 3.06 |
| Troll | 2016 | 35 | 467 | 390 | 222 | 4.2 | 2.53 |
| Troll | 2017 | 32 | 613 | 509 | 214 | 10.5 | 2.89 |
| Mixed troll and bottomfish | 2009 | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2010 | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2011 | 18 | 757 | 619 | 282 | 13.2 | 2.92 |
| Mixed troll and bottomfish | 2012 | 0 | - | - | - | - | - |
| Mixed troll and bottomfish | 2013 | 7 | 539 | 390 | 189 | 9.0 | 2.81 |
| Mixed troll and bottomfish | 2014 | 31 | 470 | 373 | 162 | 12.7 | 2.92 |
| Mixed troll and bottomfish | 2015 | 31 | 459 | 332 | 146 | 10.7 | 3.16 |
| Mixed troll and bottomfish | 2016 | 42 | 483 | 364 | 149 | 14.5 | 3.27 |
| Mixed troll and bottomfish | 2017 | 5 | 313 | 216 | 93 | 17.2 | 3.10 |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

## American Samoa Sub-fisheries

For the whole sampling period of 2009–2017, reef-fish trips had the highest potential sales value and the fishing trip costs were the lowest on average, whereas bottomfish trips had the lowest potential sales value and highest fishing trip costs on average. Figure 12 shows the average of 2009–2017 potential sales value, cost, and the respective standard error of each mean by sub-

fishery. Appendix Table D3 shows the fishing trip costs by sub-fishery, and Appendix Table D4 shows the fishing trip costs and fuel cost share by category, sub-fishery, and year.

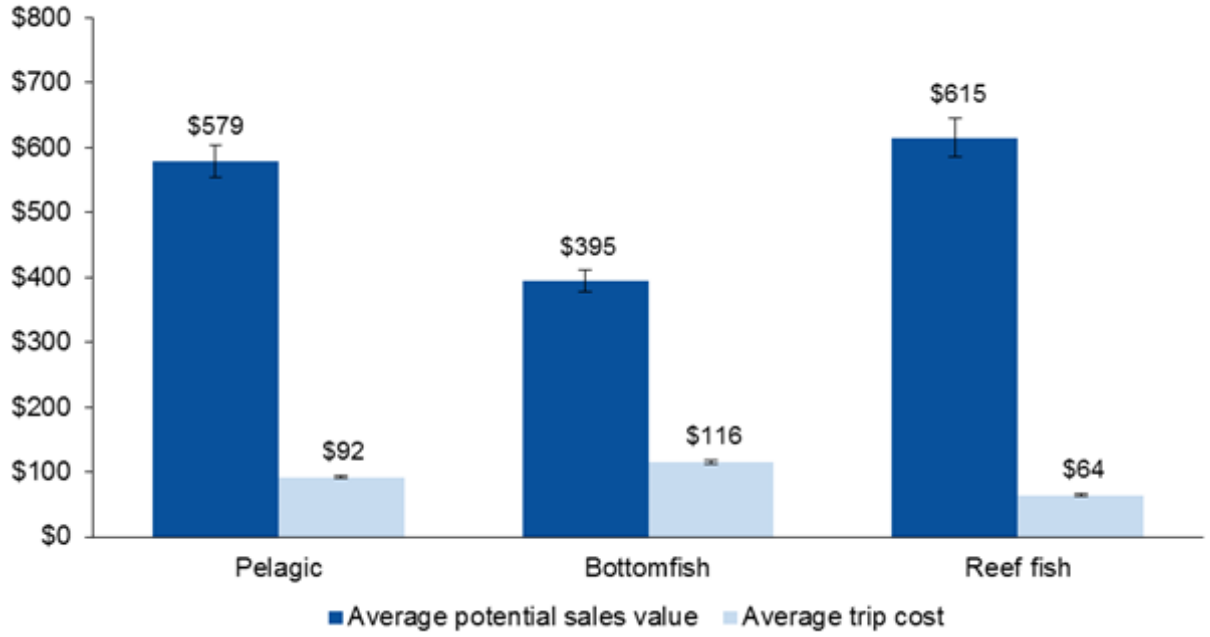


**Figure 12. Average potential sales value, average trip costs, and standard errors (shown by brackets) by sub-fishery, American Samoa small boat fishery, 2009–2017 (adjusted to 2017 dollars)**

Similar to the results by gear type, bottomfish trips had the lowest potential sales value and potential net revenue in all years due to low catch and high costs per trip. Depending on the average catch per trip, reef-fish trips had higher potential sales value and potential net revenue in some years (2010, 2013, and 2015) whereas pelagic trips had higher potential sales value and potential net revenue in other years. Table 14 shows the average per-trip potential sales value, trip cost, potential net revenue, catch, fishing hours, and fish price per pound by fishery and year.

**Table 14. Potential sales value, trip cost, potential net revenue, catch, fishing hours, and fish price per pound, on average per trip and by fishery and year, American Samoa small boat fishery (adjusted to 2017 dollars)**

| Sub-fishery | Year | *Number of interviews (n)* | Potential sales value ($) | Trip cost ($) | Potential net revenue ($) | Catch (lb) | Fishing hours (h) | Average fish price/lb ($) |
|---|---|---|---|---|---|---|---|---|
| Pelagic | 2009 | * | * | * | * | * | * | * |
| Pelagic | 2010 | * | * | * | * | * | * | * |
| Pelagic | 2011 | 33 | 637 | 105 | 533 | 259 | 6.2 | 2.66 |
| Pelagic | 2012 | 16 | 947 | 84 | 863 | 377 | 4.6 | 2.60 |
| Pelagic | 2013 | 42 | 456 | 94 | 362 | 201 | 5.5 | 2.36 |
| Pelagic | 2014 | 121 | 633 | 84 | 549 | 200 | 7.1 | 3.23 |
| Pelagic | 2015 | 80 | 460 | 95 | 365 | 138 | 7.2 | 3.12 |
| Pelagic | 2016 | 52 | 579 | 90 | 489 | 236 | 5.5 | 2.67 |
| Pelagic | 2017 | 35 | 589 | 103 | 485 | 200 | 10.4 | 2.88 |
| Bottomfish | 2009 | 4 | 880 | 138 | 742 | 312 | 17.5 | 3.18 |
| Bottomfish | 2010 | 23 | 612 | 129 | 482 | 213 | 17.1 | 3.22 |
| Bottomfish | 2011 | 45 | 546 | 116 | 430 | 179 | 13.8 | 3.11 |
| Bottomfish | 2012 | 12 | 382 | 91 | 291 | 132 | 7.8 | 3.58 |
| Bottomfish | 2013 | 30 | 395 | 136 | 257 | 117 | 11.5 | 3.29 |
| Bottomfish | 2014 | 95 | 369 | 112 | 256 | 118 | 13.1 | 3.18 |
| Bottomfish | 2015 | 101 | 386 | 101 | 285 | 114 | 11.1 | 3.40 |
| Bottomfish | 2016 | 50 | 329 | 123 | 205 | 90 | 11.5 | 3.59 |
| Bottomfish | 2017 | 54 | 273 | 127 | 146 | 84 | 10.7 | 3.13 |
| Coral reef | 2009 | * | * | * | * | * | * | * |
| Coral reef | 2010 | 46 | 907 | 63 | 844 | 268 | 6.7 | 3.31 |
| Coral reef | 2011 | * | * | * | * | * | * | * |
| Coral reef | 2012 | * | * | * | * | * | * | * |
| Coral reef | 2013 | 46 | 839 | 83 | 756 | 254 | 5.7 | 3.33 |
| Coral reef | 2014 | 60 | 389 | 64 | 324 | 124 | 6.8 | 3.17 |
| Coral reef | 2015 | 26 | 462 | 71 | 391 | 150 | 8.2 | 3.11 |
| Coral reef | 2016 | 29 | 157 | 56 | 101 | 47 | 7.6 | 3.28 |
| Coral reef | 2017 | 22 | 176 | 54 | 122 | 55 | 14.9 | 3.19 |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

## Guam Small Boat Trip Costs

### *Guam Trip Costs for All Gear Types*

Figure 13 shows the average trip costs for all gear types (itemized non-labor costs) in Guam from 2011 to 2017. All values are inflation-adjusted to 2017 dollars. The average trip cost for all gear types was $110 in 2011 (September to December), increased to an all-time high of $119 in 2012 (January to April), then dropped to $92 in 2017. Fuel cost constituted a large portion of fishing trip costs: around 70% between 2011 and 2013, and down to 50% between 2015 and 2017. The high fishing costs in 2012 was mainly due to high fuel costs ($81). The lower fishing costs in 2013 were due to lower fuel usage on average than the previous two years. While fuel use remained steady at approximately 12 gallons since 2014, fuel cost decreased due to decreasing fuel prices. Ice and bait costs were similar across years while costs of gear lost showed more variation. Figure 14 shows the fuel use and fuel price for all gear types from 2011 to 2017.

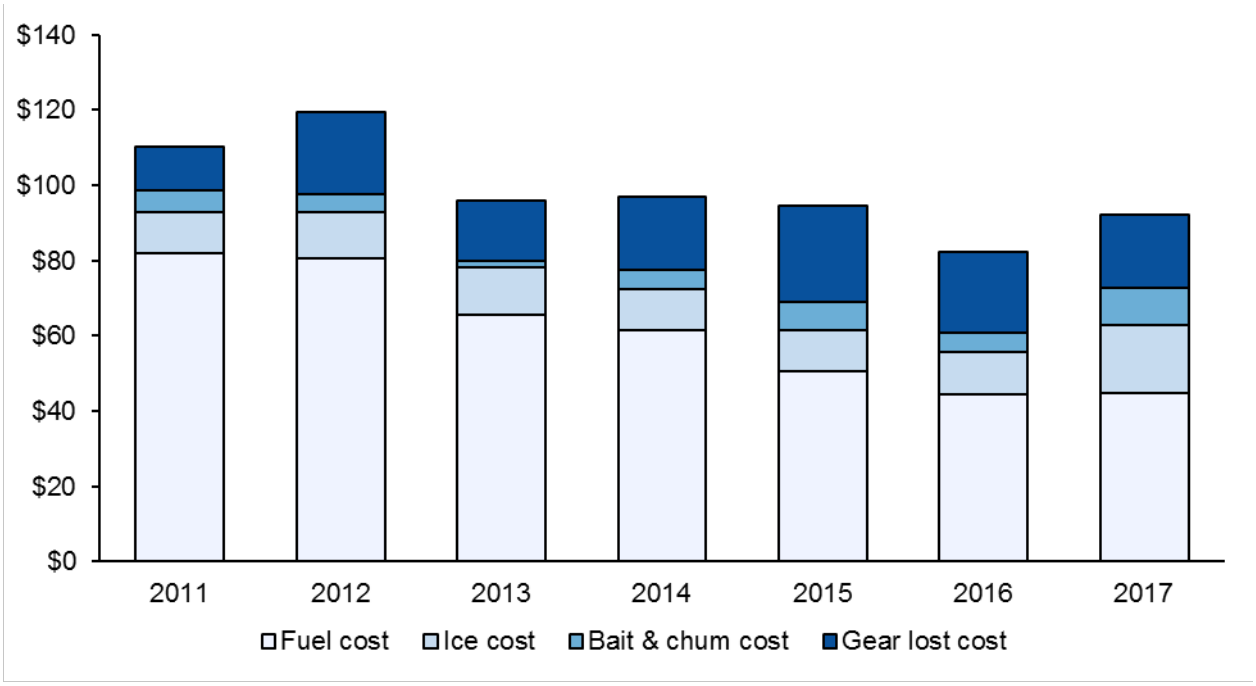


**Figure 13. Average trip costs for all gear types, Guam small boat fishery, 2011–2017 (adjusted to 2017 dollars)**

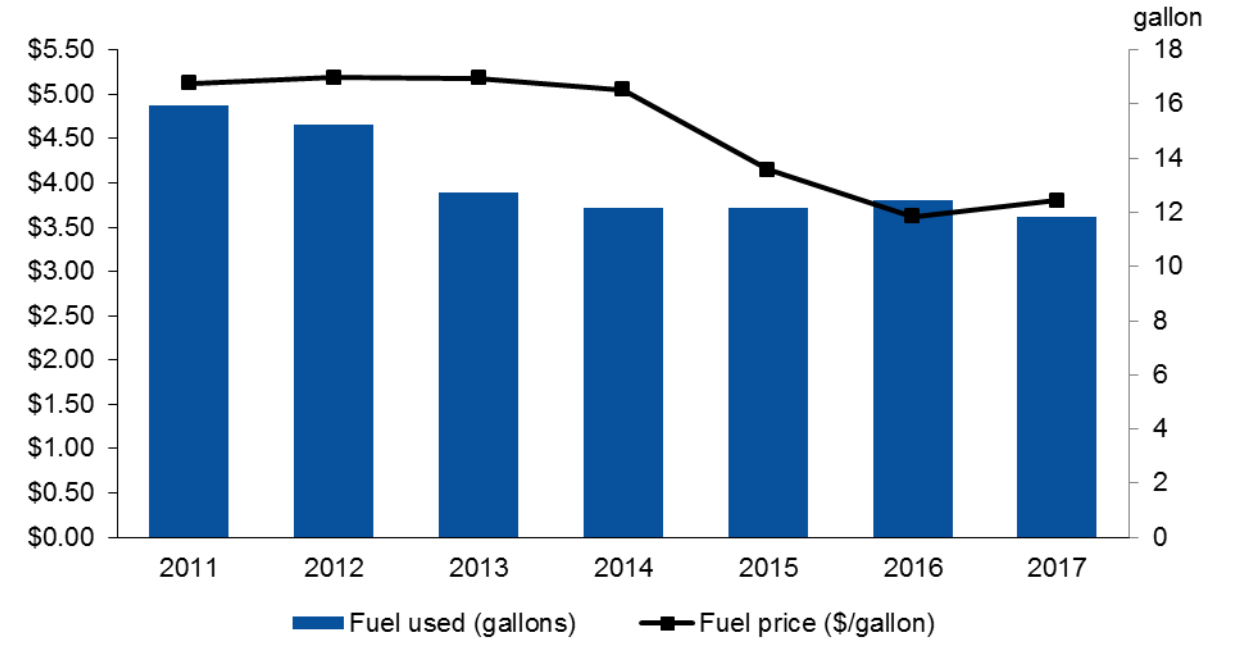


**Figure 14. Average fuel use and fuel price for all gear types, Guam small boat fishery, 2011–2017 (adjusted to 2017 dollars)**

### *Guam Trip Costs by Gear Type*

Troll is the primary gear used in the Guam small boat fishery, which lands five major pelagic species, including skipjack and yellowfin tuna, mahimahi, blue marlin, and wahoo. Bottomfish gear, sometimes combined with troll on a mixed gear trip, is also important, and it lands shallow

water and deep bottomfish. Other gears, such as gillnet, spear/snorkel, and spear/SCUBA, are used to target reef fish. The observations by gear type in the Guam trip cost survey reflect the diverse use of gear in this fishery. Three quarters of the trips in the sample were troll (76%), and the rest were mixed troll with bottomfish (9%), bottomfish only (6%), spear/snorkel (2%), and gillnet (2%). Table 15 shows the number of trips sampled by gear type from September 2011 to December 2017.

**Table 15. Number of observations by gear type in Guam small boat fishery, sample period: September 2011 to December 2017**

| Gear Type | Number | Percent |
|---|---|---|
| Troll | 900 | 76 |
| Mixed troll and bottomfish | 105 | 9 |
| Bottomfish | 73 | 6 |
| Spear/snorkel | 25 | 2 |
| Gillnet | 21 | 2 |
| Mixed troll and spear/snorkel | 14 | 1 |
| Spear/scuba | 12 | 1 |
| Atulai night light | 9 | 1 |
| Mixed troll and atulai night light | 8 | 1 |
| Mix spearfishing | 4 | 0.3 |
| Other | 20 | 2 |
| **Total** | **1,191** | **100** |

Trip costs for the Guam small boat fishery varied greatly by gear type. Figure 15 shows the trip costs by gear type in 2017. In 2017, fishermen who trolled spent $99 per trip, whereas fishermen who used mixed troll and bottomfish gears spent more on average ($107 per trip), mainly due to longer trips and therefore higher fuel costs (7.8 hours for mixed troll and bottomfish trips versus 5.8 hours for troll-only trips) along with higher bait and chum cost. Other trip types had much lower trip costs: $72 for bottomfish trips, $45 for spear/snorkel trips, and $75 for mixed troll and spear/snorkel trips. Figures 16 to 20 show the trip costs for different gear types from 2011 to 2017, including troll, mixed troll with bottomfish, bottomfish, gillnet, and spear/snorkel, respectively. Appendix Table D5 shows the total trip costs by gear and year, and Appendix Table D6 shows the fishing trip costs and fuel cost share by category, gear, and year.

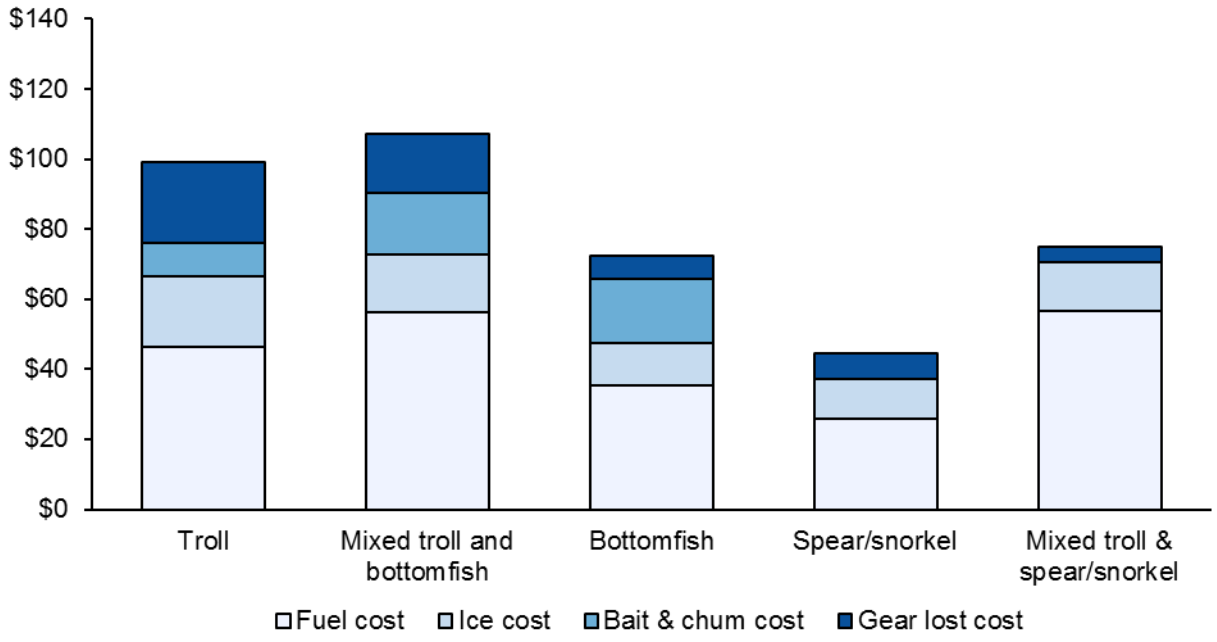


**Figure 15. Average trip costs by gear type, Guam small boat fishery, 2017**

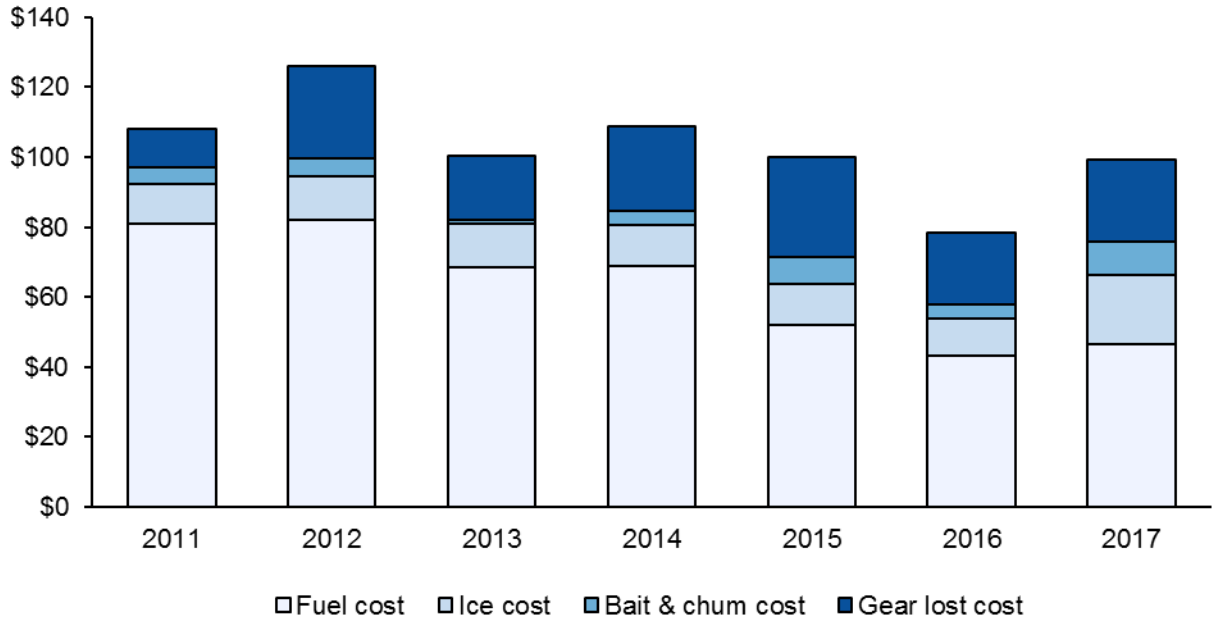


**Figure 16. Average trip costs for Guam troll trips, 2011–2017 (adjusted to 2017 dollars)**

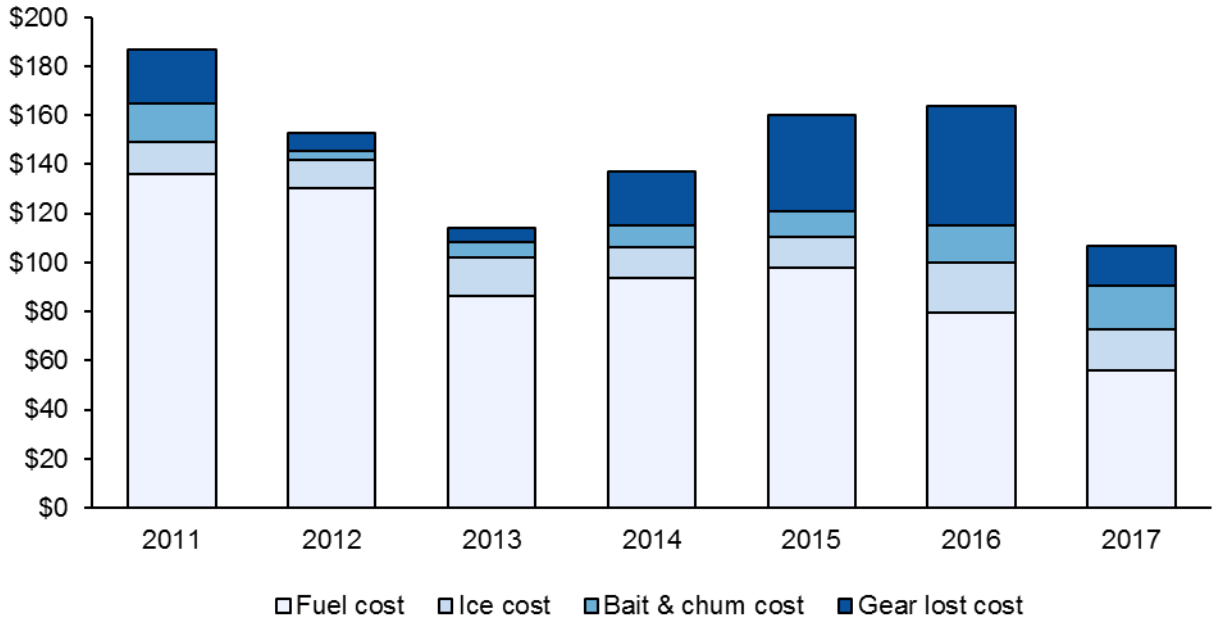


**Figure 17. Average trip costs for Guam mixed troll and bottomfish trips, 2011–2017 (adjusted to 2017 dollars)**

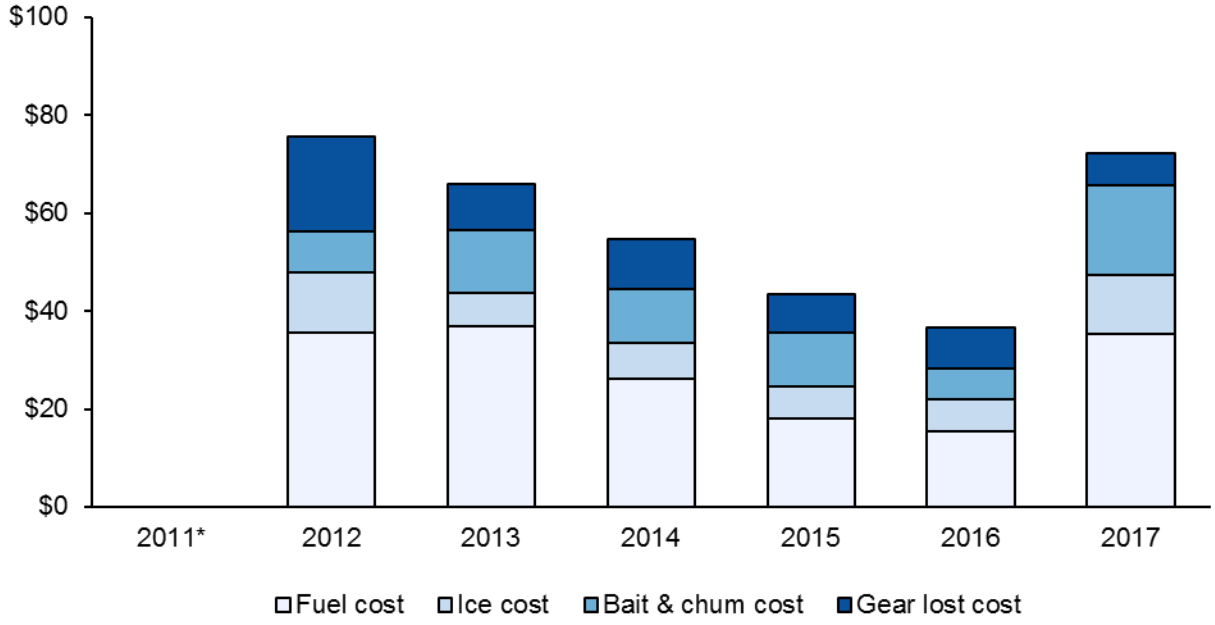


**Figure 18. Average trip costs for Guam bottomfish trips, 2011–2017 (adjusted to 2017 dollars)**

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

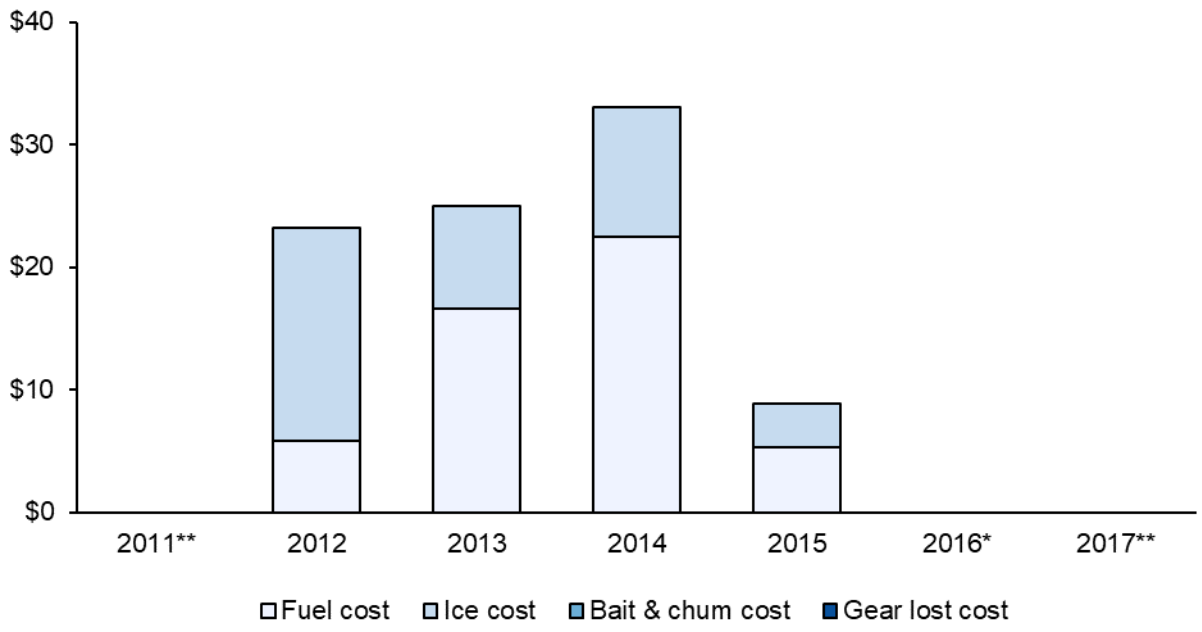


**Figure 19. Average trip costs for Guam gillnet trips, 2011–2017 (adjusted to 2017 dollars)**

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.
** No sample, n=0.

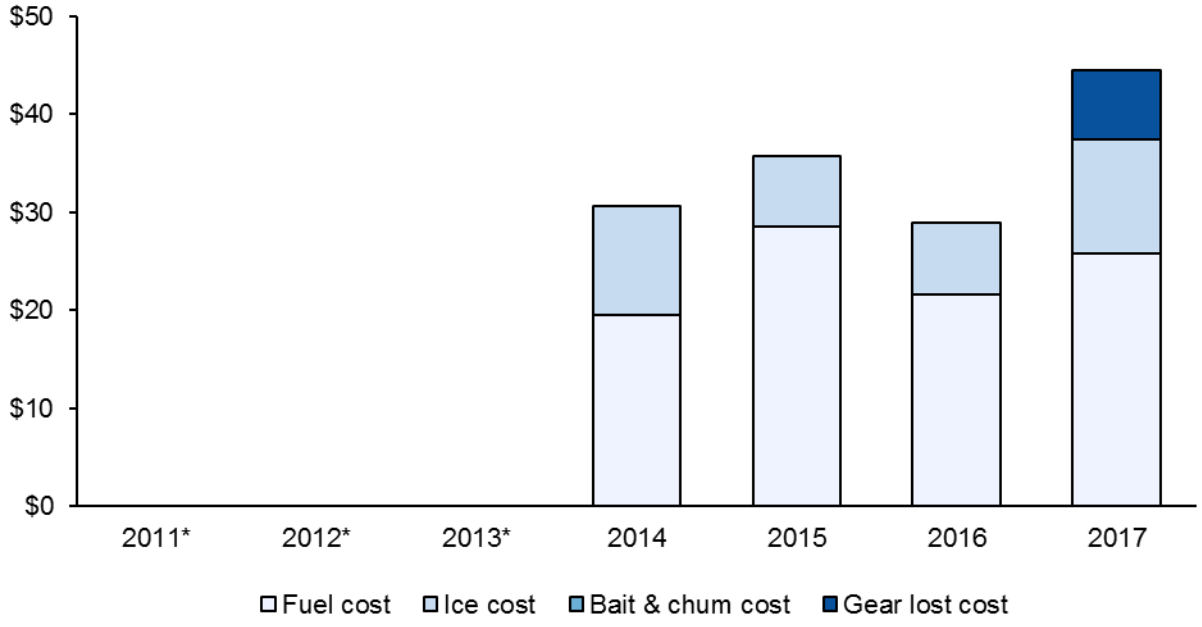


**Figure 20. Average trip costs for Guam spear/snorkel trips, 2011–2017 (adjusted to 2017 dollars)**

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

### *Guam Monthly Fuel Price*

The fuel price per gallon was around $5 between 2011 and mid-2014 and it started to drop in mid-2014 and fell below $4 since October 2015. Figure 21 shows the average fuel price paid by small boat fishermen in Guam from September 2011 to December 2017.

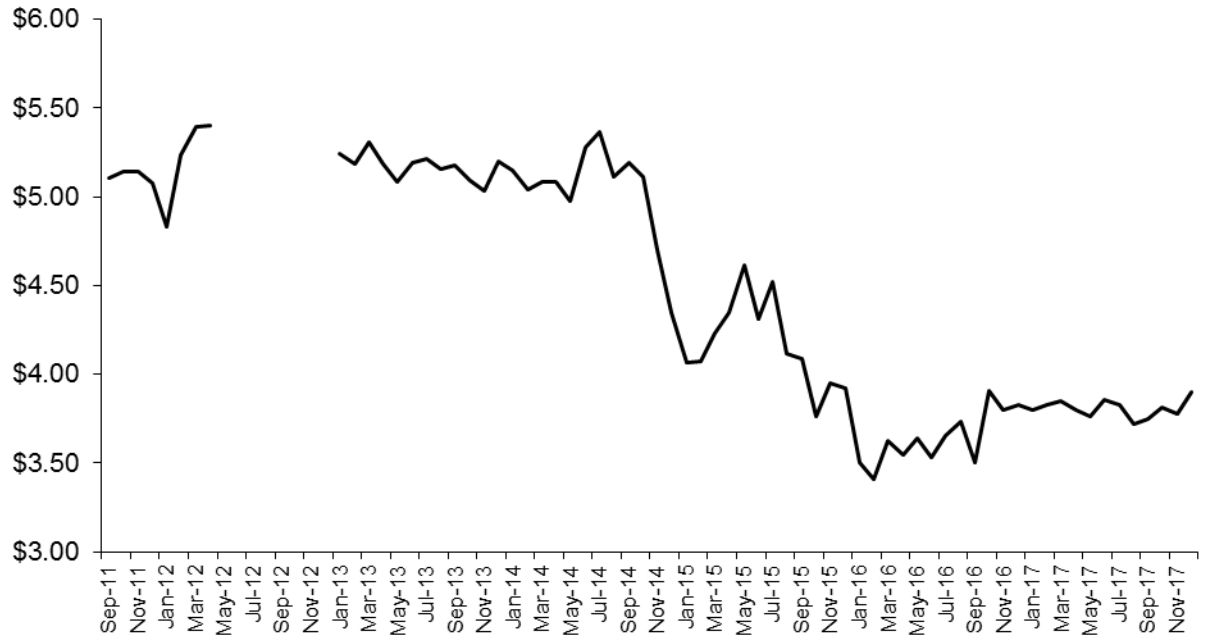


**Figure 21. Average monthly fuel price paid by fishermen, Guam small boat fishery, 2011–2017 (adjusted to 2017 dollars)**

## Guam Potential Sales Value of Fishing Trip

The average percent of catch intended for sale was 48% over the period 2011–2017, ranging from 38% in 2011 to 58% in 2017. Between September 2011 and 2017, the average percent of catch intended for sale was 59% for troll trips, 29% for gillnet trips, 24% for spear/snorkel trips, 17% for mixed troll and bottomfish trips, and 1% for bottomfish trips.

The average potential sales values of fishing trips ranged from $92 in 2011 to $176 in 2015, and dropped to $117 in 2017. The potential sales values were higher than the average trip costs (hence, positive potential net revenue) for most of the years except 2011 and 2016. Figure 22 shows the average potential sales value, the average trip costs, and the respective standard errors of the means in Guam from September 2011 to 2017. The high potential sales values in 2013 and 2015 were mainly due to greater catches per trip and the slightly higher percent of catch intended for sale when compared with other years. Fish price was another factor for the high potential sales value in 2013, as the average fish price in 2013 was the highest across years. The drops in potential sales value in 2016 and 2017 were due to low catch per trip. Figure 23 shows the average total catch per trip, fishing hours per trip, and catch per fishing hour for all gear types from 2011 to 2017, and Figure 24 shows the percent of catch intended for sale per trip and the average fish price per pound for all gear types from 2011 to 2017.

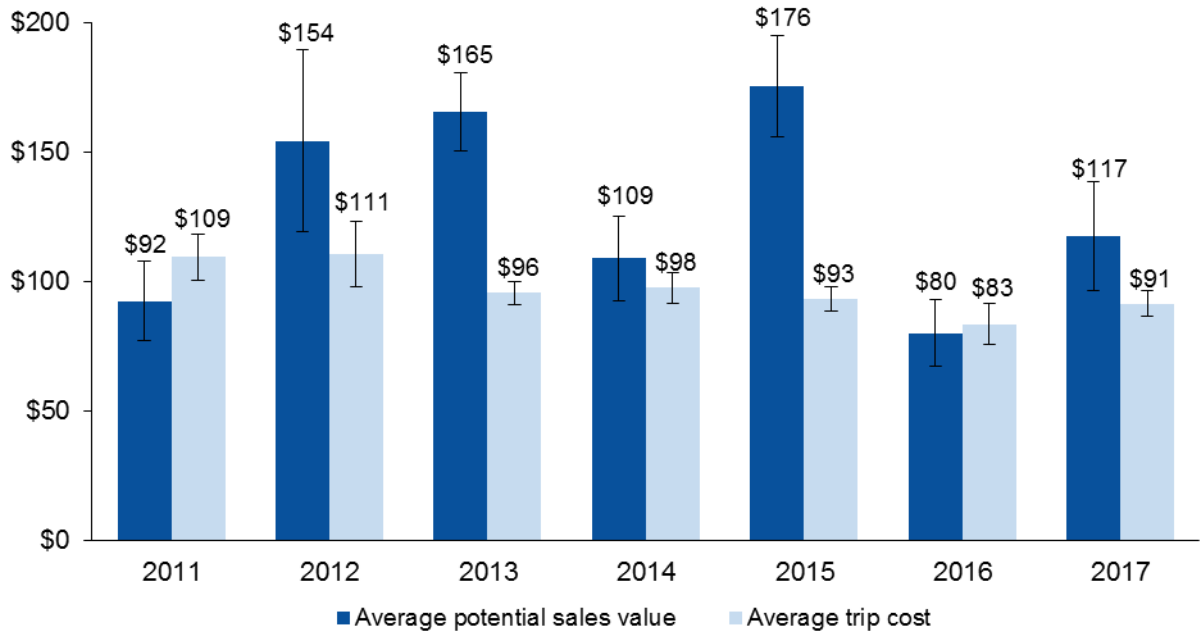


**Figure 22. Average potential sales value, average trip costs*, and standard errors (shown by blankets) for all gear types, Guam small boat fishery, 2011–2017 (adjusted to 2017 dollars)**

* Note: annual trip costs are slightly different from Figure 13 due to some trips with no disposition records and therefore no sales value, which were eliminated from this analysis.

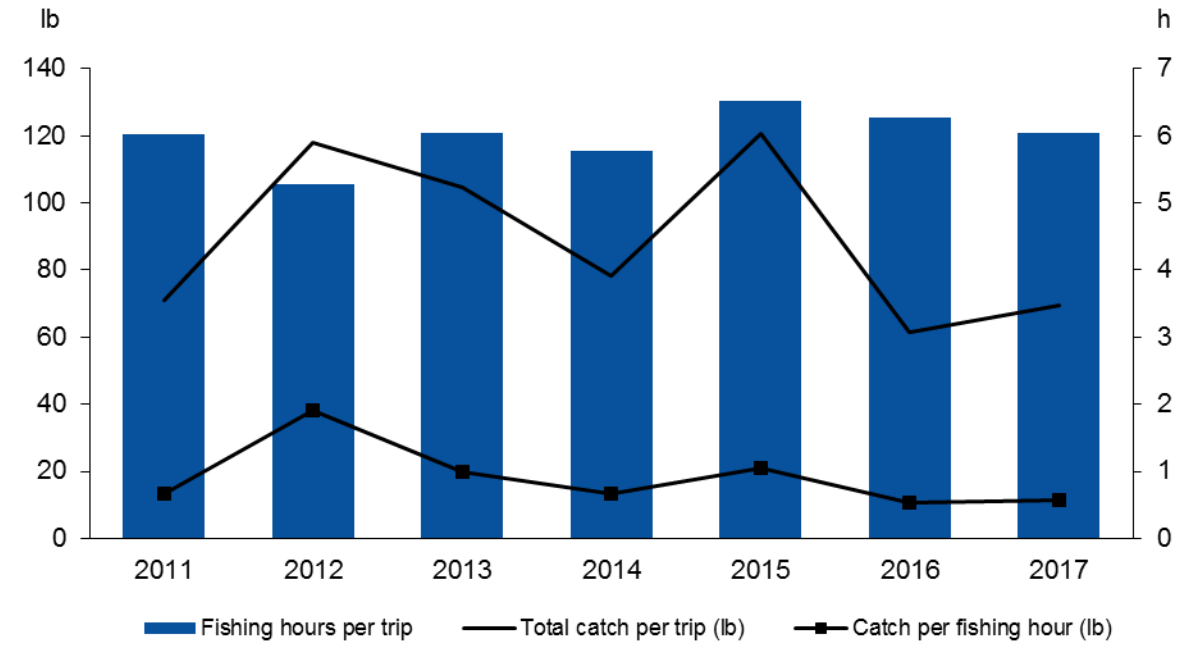


**Figure 23. Average total catch per trip, fishing hours per trip, and catch per fishing hour for all gear types, Guam small boat fishery, 2011–2017**

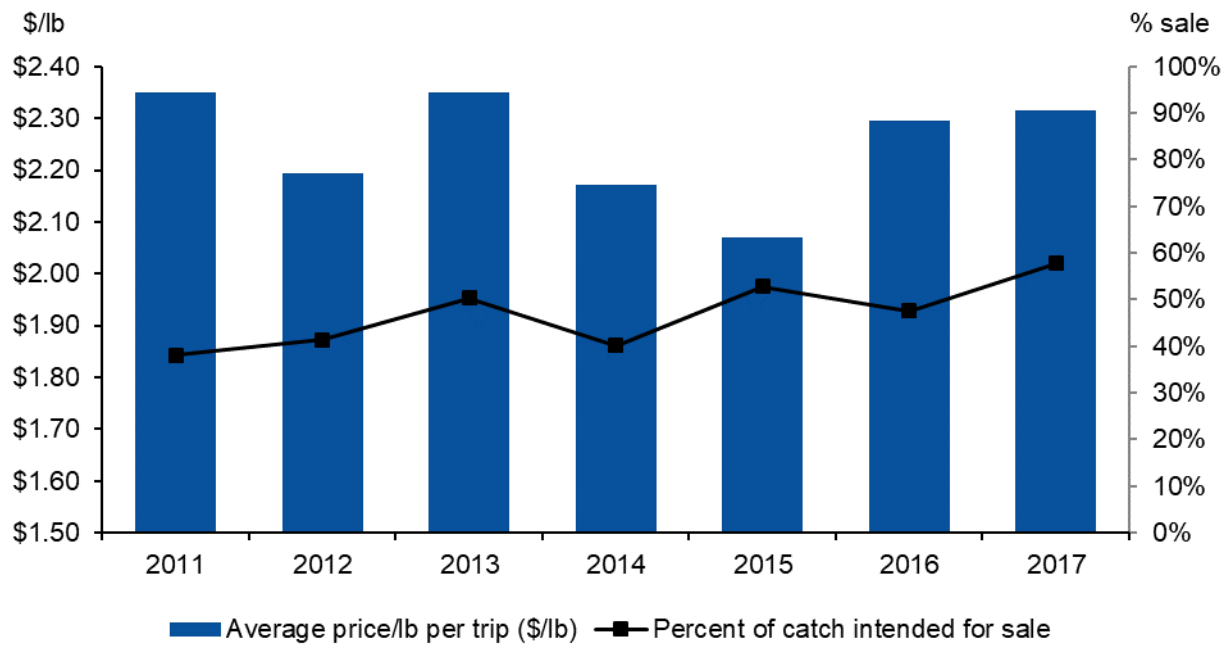


**Figure 24. Percent of catch intended for sale per trip and average fish price per pound for all gear types, Guam small boat fishery, 2011–2017 (adjusted to 2017 dollars)**

### *Guam Potential Sales Value of Fishing Trip by Gear Type*

Potential sales values varied greatly by gear type in the Guam small boat fishery, affected most by the percent of the catch intended for sale. Because almost none of the catch from (solely) bottomfish trips were intended for sale, bottomfish trips showed no or very low sales value and thus negative potential net revenue in all years. However, this means that almost all of the bottomfish caught were intended for self-consumption or shared with friends or family, so although bottomfish trips show minimal commercial value, they are important culturally. For troll trips, although the average prices for pelagic fish were low compared with other species, the high catch per trip and high percent of catch intended for sale (59% between 2011 and 2017) allow most of the years to have positive potential net revenue (except for 2011). Mixed troll and bottomfish trips fall between the two extremes, with higher average fish prices than troll trips, but because of the low percent of catch intended for sale (17% between 2011 and 2017), potential sales values were low and potential net revenues were negative for all years. Gillnet trips showed the highest potential sales value and potential net revenue between 2012 and 2014, mainly due to the high catch per trip and low trip costs. Table 16 shows the average per-trip potential sales value, potential net revenue, catch, fishing hours, and fish price per pound by gear and year.

**Table 16. Potential sales value, potential net revenue, catch, fishing hours, and fish price per pound, on average per trip and by gear and year, Guam small boat fishery (adjusted to 2017 dollars)**

| Gear | Year | *Number of interviews (n)* | Potential sales value ($) | Potential net revenue ($) | Catch (lb) | Fishing hours (h) | Fish price/lb ($) |
|---|---|---|---|---|---|---|---|
| Troll | 2011 | 78 | 100 | (6) | 74 | 5.7 | 2.18 |
| Troll | 2012 | 39 | 164 | 43 | 117 | 5.2 | 2.16 |
| Troll | 2013 | 217 | 184 | 84 | 114 | 6.0 | 2.30 |
| Troll | 2014 | 111 | 143 | 32 | 90 | 5.4 | 2.04 |
| Troll | 2015 | 181 | 203 | 103 | 137 | 6.4 | 2.00 |
| Troll | 2016 | 96 | 88 | 9 | 64 | 6.2 | 2.15 |
| Troll | 2017 | 127 | 151 | 51 | 86 | 6.2 | 2.28 |
| Mixed troll and bottom | 2011 | 16 | 39 | (148) | 65 | 8.4 | 3.41 |
| Mixed troll and bottom | 2012 | 4 | 34 | (86) | 59 | 6.0 | 2.27 |
| Mixed troll and bottom | 2013 | 20 | 42 | (74) | 63 | 8.9 | 2.37 |
| Mixed troll and bottom | 2014 | 16 | 42 | (93) | 74 | 8.2 | 2.57 |
| Mixed troll and bottom | 2015 | 11 | 0 | (125) | 58 | 7.9 | ** |
| Mixed troll and bottom | 2016 | 16 | 87 | (82) | 93 | 9.3 | 3.31 |
| Mixed troll and bottom | 2017 | 9 | 34 | (59) | 22 | 7.6 | 2.50 |
| Bottom | 2011 | * | * | * | * | * | * |
| Bottom | 2012 | 5 | 0 | (76) | 38 | 7.4 | ** |
| Bottom | 2013 | 8 | 0 | (66) | 34 | 5.1 | ** |
| Bottom | 2014 | 21 | 8 | (36) | 36 | 6.6 | 3.58 |
| Bottom | 2015 | 10 | 0 | (49) | 11 | 5.3 | ** |
| Bottom | 2016 | 6 | 0 | (35) | 11 | 2.2 | ** |
| Bottom | 2017 | 12 | 19 | (57) | 24 | 5.0 | 2.88 |
| Gillnet | 2011 | 0 | - | - | - | - | - |
| Gillnet | 2012 | 3 | 447 | 424 | 348 | 2.3 | 2.68 |
| Gillnet | 2013 | 9 | 299 | 274 | 137 | 2.7 | 3.08 |
| Gillnet | 2014 | 5 | 239 | 206 | 109 | 3.5 | 3.54 |
| Gillnet | 2015 | 3 | 0 | (9) | 41 | 3.0 | ** |
| Gillnet | 2016 | 1 | 0 | (17) | 10 | 3.0 | ** |
| Gillnet | 2017 | 0 | - | - | - | - | - |
| Spear/snorkel | 2011 | * | * | * | * | * | * |
| Spear/snorkel | 2012 | 0 | - | - | - | - | - |
| Spear/snorkel | 2013 | * | * | * | * | * | * |
| Spear/snorkel | 2014 | 4 | 31 | 0 | 39 | 3.3 | 3.12 |
| Spear/snorkel | 2015 | 5 | 0 | (40) | 16 | 9.9 | ** |
| Spear/snorkel | 2016 | 4 | 17 | (12) | 35 | 4.3 | 3.34 |
| Spear/snorkel | 2017 | 7 | 8 | (36) | 5 | 3.7 | 3.01 |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.
** No sales.

## Guam Sub-fisheries

For the whole sampling period of 2011–2017, pelagic trips had the highest potential sales value, but also the highest trip costs. Although the potential sales value for the reef-fish sub-fishery was on average $65 lower than the pelagic sub-fishery, reef-fish trip costs were the lowest among the three sub-fisheries, resulting in potential net revenue similar to pelagic. Figure 25 shows the

average potential sales value, cost, and the respective standard error of each mean by sub-fishery for 2011–2017. Appendix Table D7 shows the fishing trip costs by sub-fishery, and Appendix Table D8 shows the fishing trip costs and fuel-cost share by category, sub-fishery, and year.

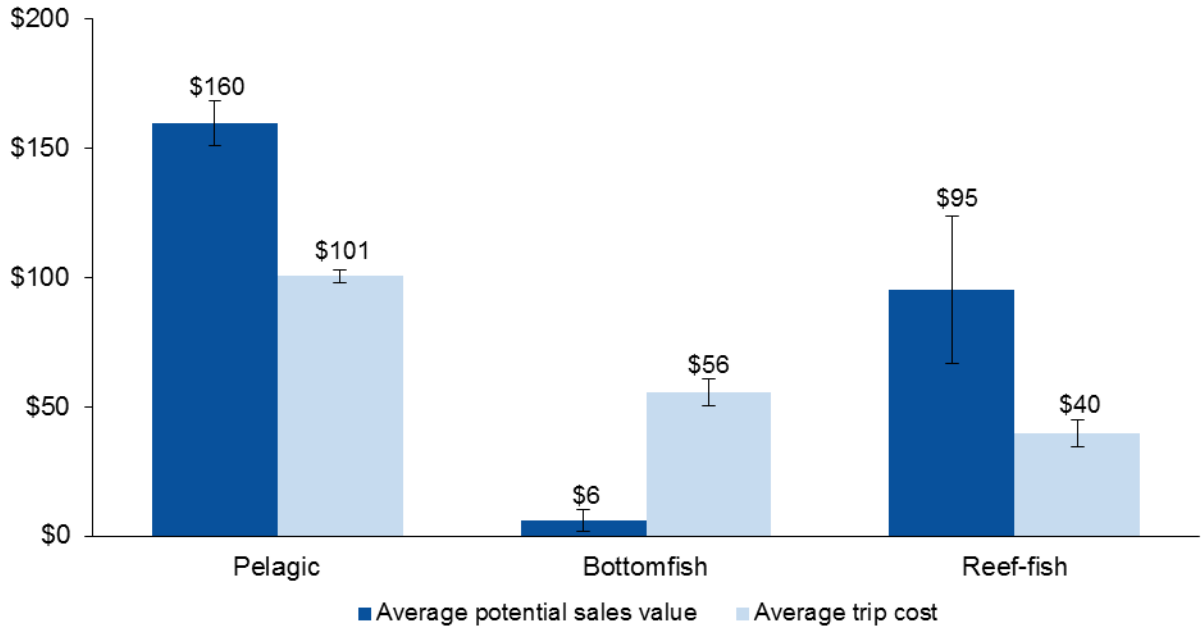


**Figure 25. Average potential sales value, average trip costs, and standard errors (shown by blankets) by sub-fishery, Guam small boat fishery, 2011–2017 (adjusted to 2017 dollars)**

Between the three Guam sub-fisheries, reef-fish trips had higher potential net revenue (except 2015 and 2017, which had low catch) as reef fish prices were higher than pelagic fish prices, and their trip costs were the lowest. Although pelagic trips had the highest average catch per trip between 2013 and 2017, due to high trip costs and low pelagic fish prices, the potential net revenue was the highest of the sub-fisheries only in 2015 and 2017. Table 17 shows average per-trip potential sales value, trip cost, potential net revenue, catch, fishing hours, and fish price per pound by fishery and year.

**Table 17. Potential sales value, trip cost, potential net revenue, catch, fishing hours, and fish price per pound, on average per trip and by fishery and year, Guam small boat fishery (adjusted to 2017 dollars)**

| Sub-fishery | Year | *Number of interviews (n)* | Potential sales value ($) | Trip cost ($) | Potential net revenue ($) | Catch (lb) | Fishing hours (h) | Fish price/lb ($) |
|---|---|---|---|---|---|---|---|---|
| Pelagic | 2011 | 78 | 100 | 107 | (6) | 74 | 5.7 | 2.18 |
| Pelagic | 2012 | 39 | 164 | 121 | 43 | 117 | 5.2 | 2.16 |
| Pelagic | 2013 | 215 | 186 | 101 | 85 | 114 | 6.1 | 2.30 |
| Pelagic | 2014 | 111 | 143 | 111 | 32 | 90 | 5.4 | 2.04 |
| Pelagic | 2015 | 177 | 208 | 99 | 109 | 140 | 6.4 | 2.00 |
| Pelagic | 2016 | 95 | 89 | 79 | 10 | 64 | 6.2 | 2.15 |
| Pelagic | 2017 | 128 | 150 | 98 | 51 | 85 | 6.2 | 2.28 |
| Bottomfish | 2011 | * | * | * | * | * | * | * |
| Bottomfish | 2012 | 5 | 0 | 76 | (76) | 38 | 7.4 | ** |
| Bottomfish | 2013 | 8 | 0 | 66 | (66) | 34 | 5.1 | ** |
| Bottomfish | 2014 | 21 | 8 | 44 | (36) | 36 | 6.6 | 3.58 |
| Bottomfish | 2015 | 10 | 0 | 49 | (49) | 11 | 5.3 | ** |
| Bottomfish | 2016 | 6 | 0 | 35 | (35) | 11 | 2.2 | ** |
| Bottomfish | 2017 | 12 | 19 | 75 | (57) | 24 | 5.0 | 2.88 |
| Coral reef | 2011 | 7 | 204 | 21 | 182 | 93 | 4.6 | 3.23 |
| Coral reef | 2012 | 3 | 447 | 23 | 424 | 348 | 2.3 | 2.68 |
| Coral reef | 2013 | 17 | 169 | 29 | 140 | 92 | 2.9 | 3.09 |
| Coral reef | 2014 | 15 | 96 | 39 | 57 | 60 | 4.0 | 3.21 |
| Coral reef | 2015 | 16 | 7 | 59 | (52) | 19 | 6.3 | 3.59 |
| Coral reef | 2016 | 11 | 58 | 36 | 22 | 32 | 4.1 | 3.23 |
| Coral reef | 2017 | 14 | 4 | 49 | (44) | 13 | 3.5 | 3.01 |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.
** No sales.

## CNMI Small Boat Trip Costs

### *CNMI Trip Costs for all Gear Types*

Figure 26 itemizes the average non-labor trip costs for all gear types in the CNMI from 2009 to 2017. All values are inflation-adjusted to 2017 dollars. Fuel costs constituted a large portion of fishing trip costs, ranging from 86% of total costs in 2009 to 92% of total costs in 2013. The average trip cost was $56 in 2009, increased to an all-time high at $88 in 2013, and dropped to $72 in 2017. The increasing trend of fishing costs from 2009 to 2011 was primarily due to increasing fuel prices while the increase in fishing costs from 2011 to 2013 was due to higher fuel use per trip. Fuel use after 2013 became steady at around 16 gallons per trip. The decreasing trend in trip costs after 2013 was due to decreasing fuel prices. Non-fuel costs were similar across years. Figure 27 shows the fuel use and fuel prices for all gear types from 2009 to 2017.

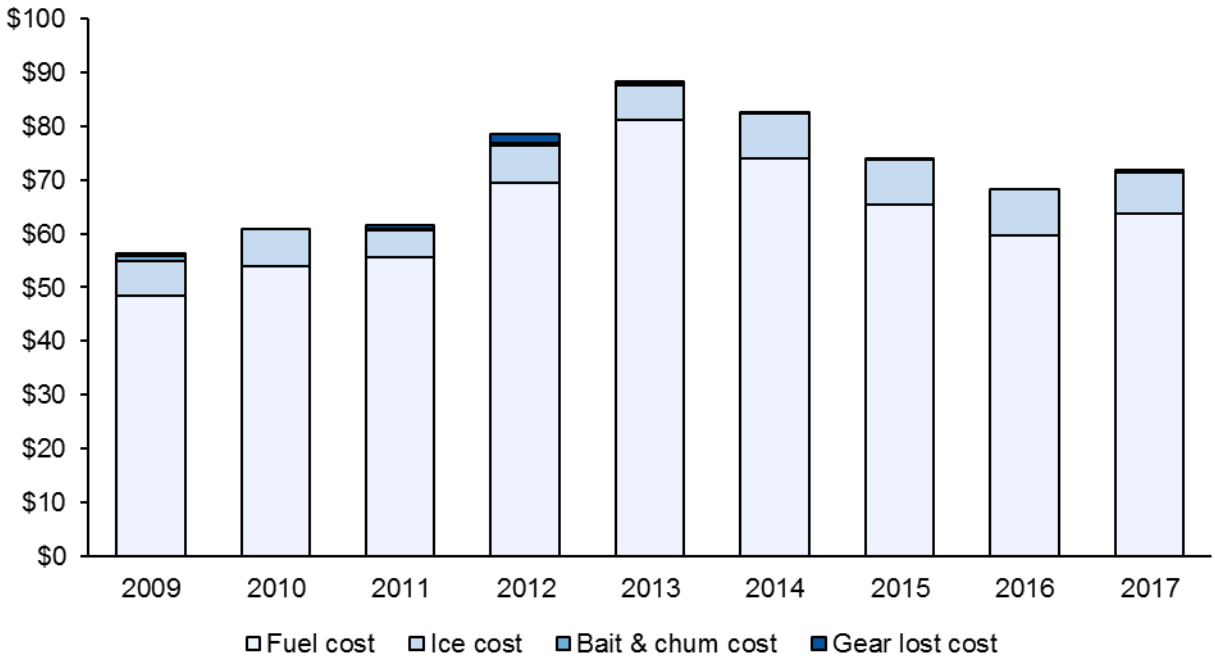


**Figure 26. Average trip costs for all gear types, CNMI small boat fishery, 2009–2017 (adjusted to 2017 dollars)**

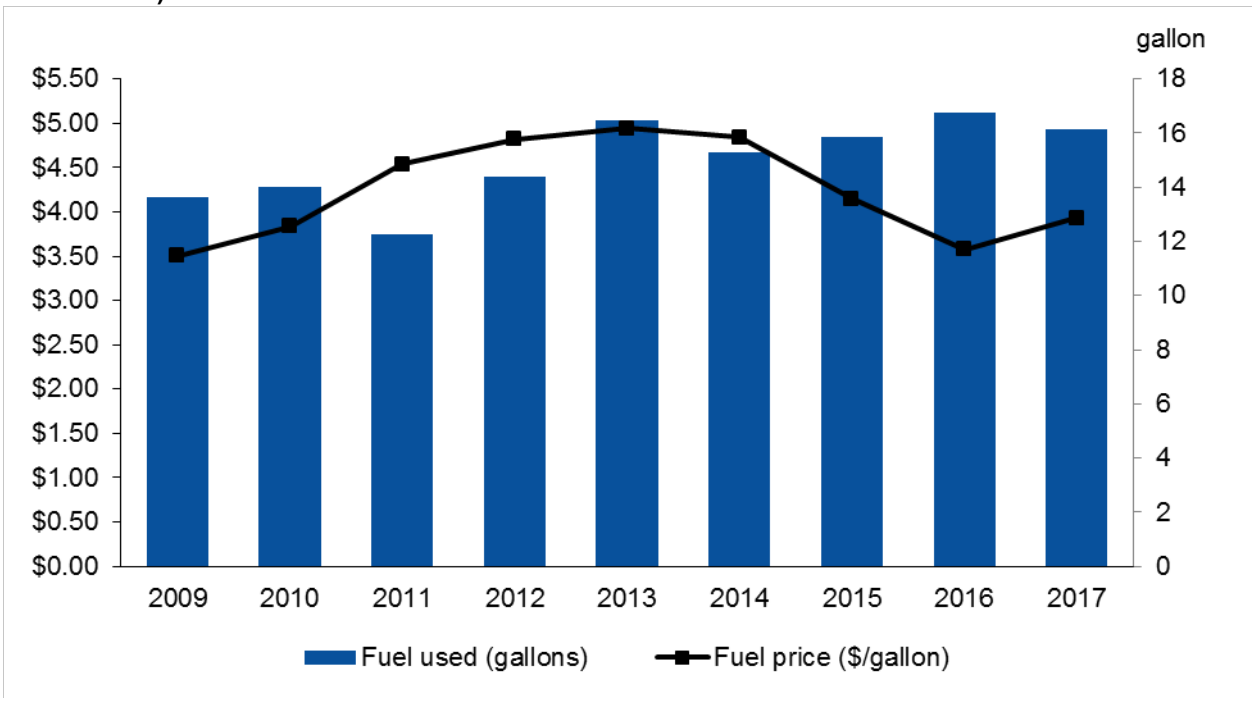


**Figure 27. Average fuel use and fuel price for all gear types, CNMI small boat fishery, 2009–2017 (adjusted to 2017 dollars)**

### *CNMI Trip Costs by Gear Type*

Troll is the primary gear used in the CNMI pelagic fishery. The primary target species is skipjack tuna, while other targets include yellowfin tuna and mahimahi. The bottomfish gears include those used for shallow-water bottom fishing and deep-water bottom fishing. Shallow-

water bottom fishing targets species such as redgill emperor, black jack, and matai, whereas deep-water bottom fishing targets species such as onaga, ehu, and yellowtail kalekale. Other gears include spear/snorkel, nets, and atulai. The number of observations by gear type for the trip cost survey covers the gear used in the three fisheries. The highest gear usage in the sample was troll (78%), followed by bottomfish (15%), spear/snorkel (3%), and mixed troll and bottomfish (2%). Table 18 shows the number of trips sampled by gear type from April 2009 to December 2017.

**Table 18. Number of observations by gear type in the CNMI small boat fishery, sample period: April 2009 to December 2017**

| Gear Type | Number | Percent |
|---|---|---|
| Troll | 733 | 78 |
| Bottomfish | 139 | 15 |
| Spear/snorkel | 28 | 3 |
| Mixed troll and bottomfish | 22 | 2 |
| Atulai | 12 | 1 |
| Cast net | 5 | 1 |
| Other | 4 | 0.4 |
| **Total** | **943** | **100** |

Trip costs for the CNMI small boat fishery varied by gear type. Figure 28 gives an example of the trip costs by gear type in 2017 when CNMI fishermen who trolled spent $76 per trip, while fishermen who made bottomfish trips spent half of that at $38 per trip. Fuel costs comprised about 90% of trip costs, and ice costs comprised the rest. Figures 29 to 32 show the trip costs for different gear types from 2009 to 2017, including troll, bottomfish, spear/snorkel, and mixed troll with bottomfish, respectively. Appendix Table D9 shows the total trip costs by gear and year, and Appendix Table D10 shows the fishing trip costs and fuel cost share by category, gear, and year.

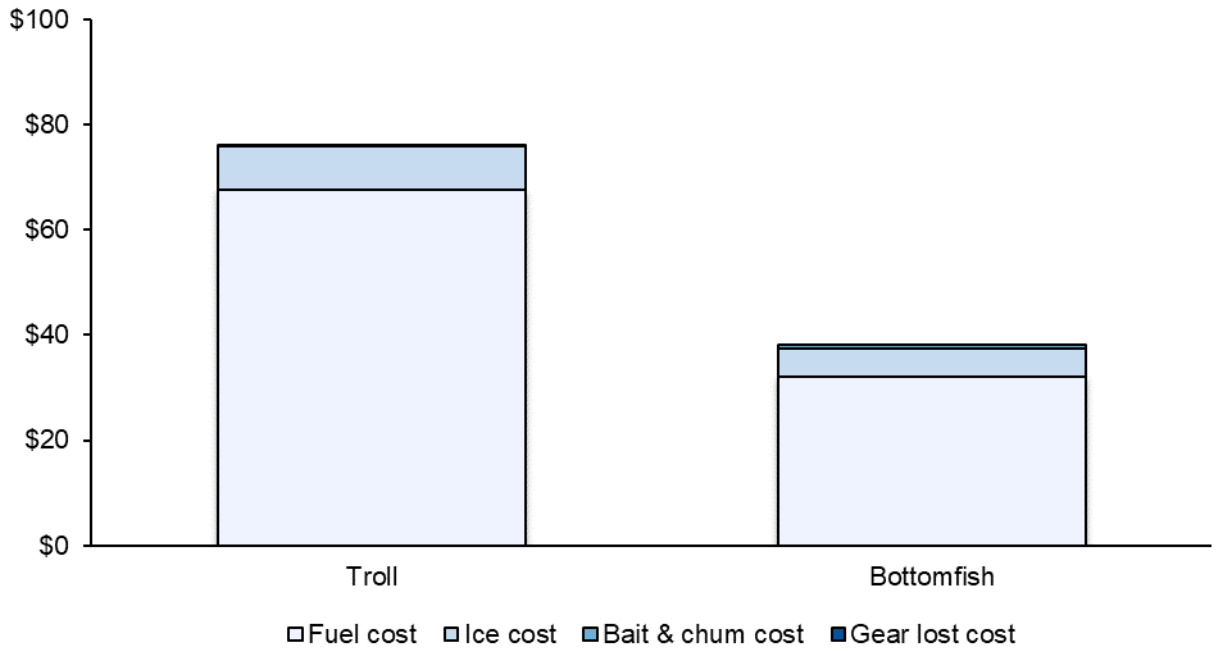


**Figure 28. Average trip costs by gear type, CNMI small boat fishery, 2017.**

Note: Other gears omitted due to small number of responses.

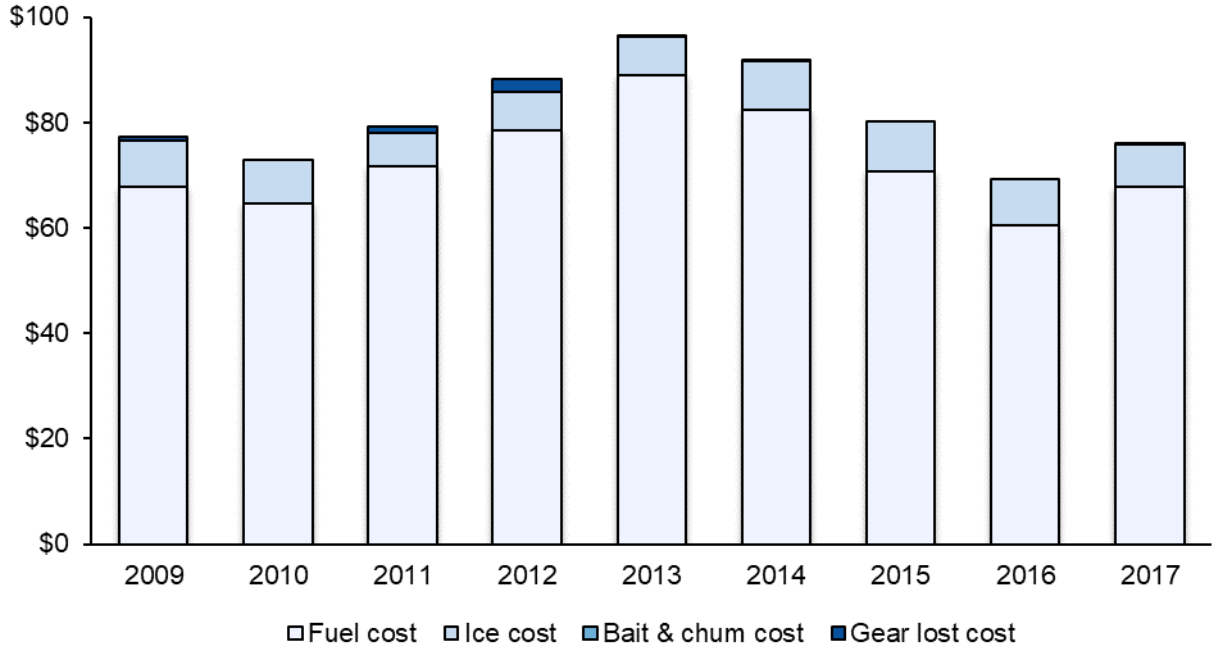


**Figure 29. Average trip costs for CNMI troll trips, 2009–2017 (adjusted to 2017 dollars)**

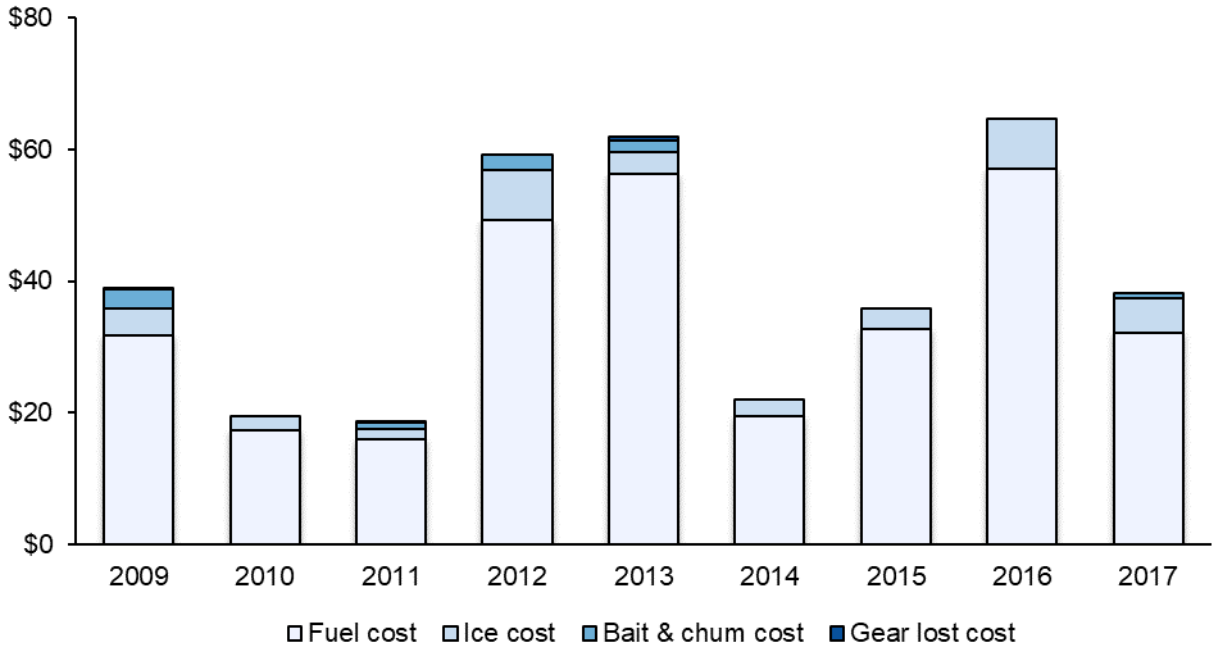


**Figure 30. Average trip costs for CNMI bottomfish trips, 2009–2017 (adjusted to 2017 dollars)**

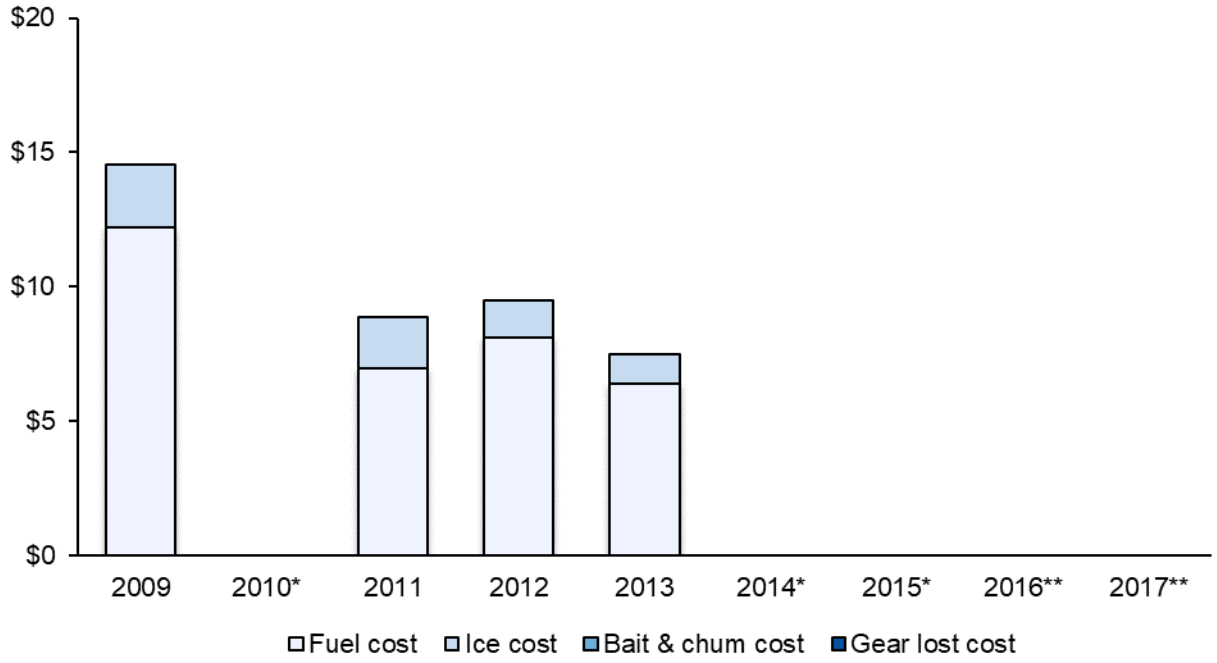


**Figure 31. Average trip costs for CNMI spear/snorkel trips, 2009–2017 (adjusted to 2017 dollars)**

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.
** No sample, n=0.

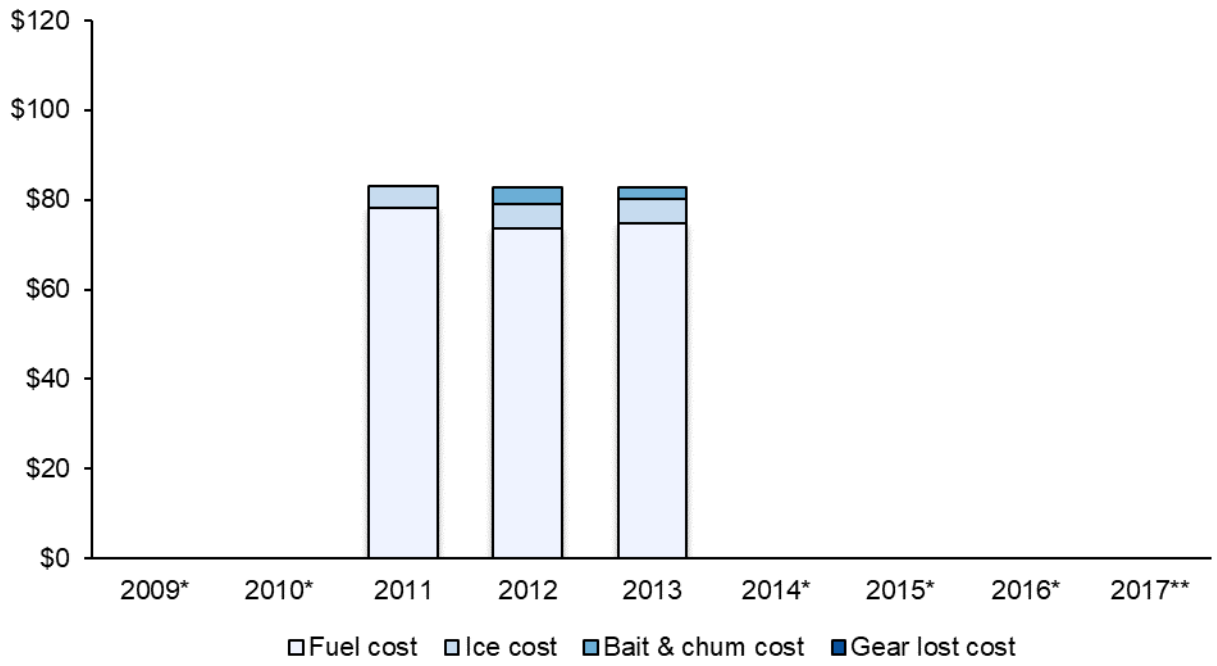


**Figure 32. Average trip costs for CNMI mixed troll and bottomfish trips, 2009–2017 (adjusted to 2017 dollars)**

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.
** No sample, n=0.

### *CNMI Monthly Fuel Price*

Fuel costs constituted a large portion of fishing trip costs in the CNMI. Figure 33 shows fuel prices from 2009 to 2017. Fuel prices were increasing over time from $3.08 in April 2009 to around $5 between 2012 and September 2014. After that, fuel prices continued to fall until at $3.50 in mid-2016, and went back up around $4 in mid-2017.

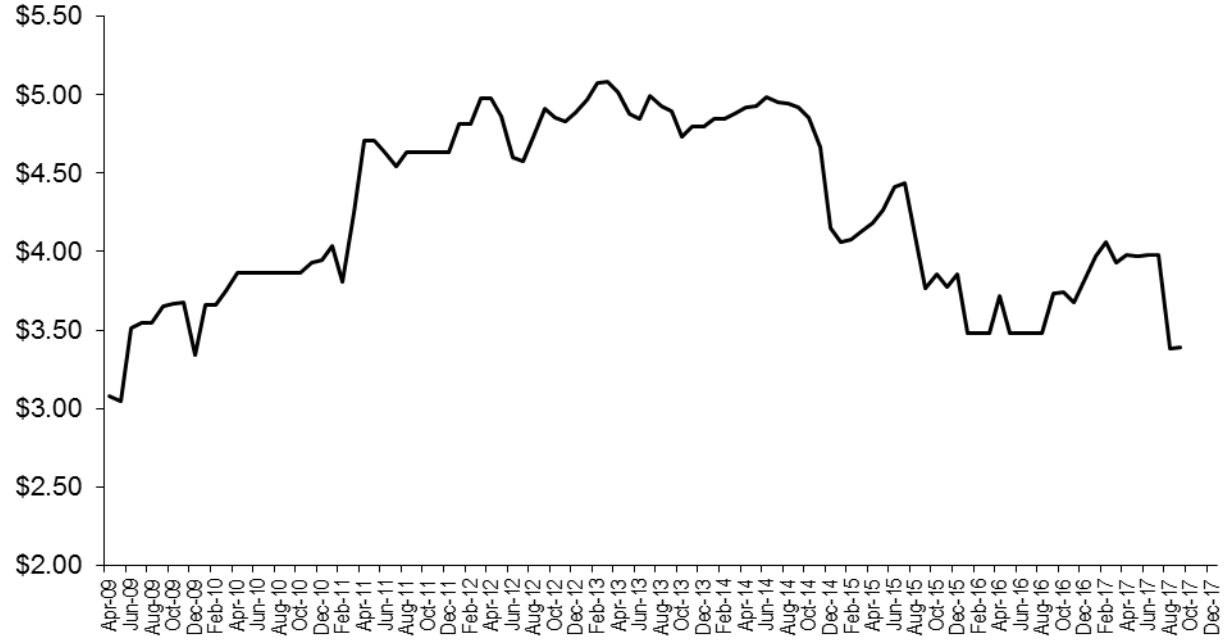


**Figure 33. Average monthly fuel price paid by fishermen, CNMI small boat fishery, 2009–2017 (adjusted to 2017 dollars)**

## CNMI Potential Sales Value of Fishing Trip

The average percent of catch intended for sale in the CNMI was 75% over the period 2009–2017. The average percent intended for sale by year ranged from 56% in 2009 to 84% in 2014. Within the period of 2009–2017, the average percent of catch intended for sale was 88% for troll trips, 60% for mixed troll with bottomfish trips, 26% for spear/snorkel trips, and 26% for bottomfish trips.

The average potential sales value of a fishing trip ranged from $117 in 2009 to $302 in 2017. It almost doubled from 2011 to 2012, and then remained in the range of $200–300 between 2013 and 2017. The potential sales values were greater than the average trip costs for all years. Figure 34 shows the average potential sales value, the average trip costs, and the respective standard errors of the means in the CNMI from 2009 to 2017. The major increase in average potential sales value from 2011 to 2012 was mainly due to the increase in total catch per trip (+58%) in 2012. After the high value in 2012, the average potential sales value fluctuated mainly due to the variation in catch per trip. The average potential sales value was the highest in 2017 due to an increase in total catch per trip (+24%) and fish price (+20%) compared with 2016. Fish prices showed a steady increase between 2010 and 2017 (with a drop in 2016), and the portion of the catch intended for sale also showed an increasing trend since 2011 and remained at around 80% between 2013 and 2017. Figure 35 shows the average total catch per trip, fishing hours per trip, and catch per fishing hour for all gear types from 2009 to 2017, and Figure 36 shows the percent of catch intended for sale per trip and the average fish price per pound for all gear types from 2009 to 2017.

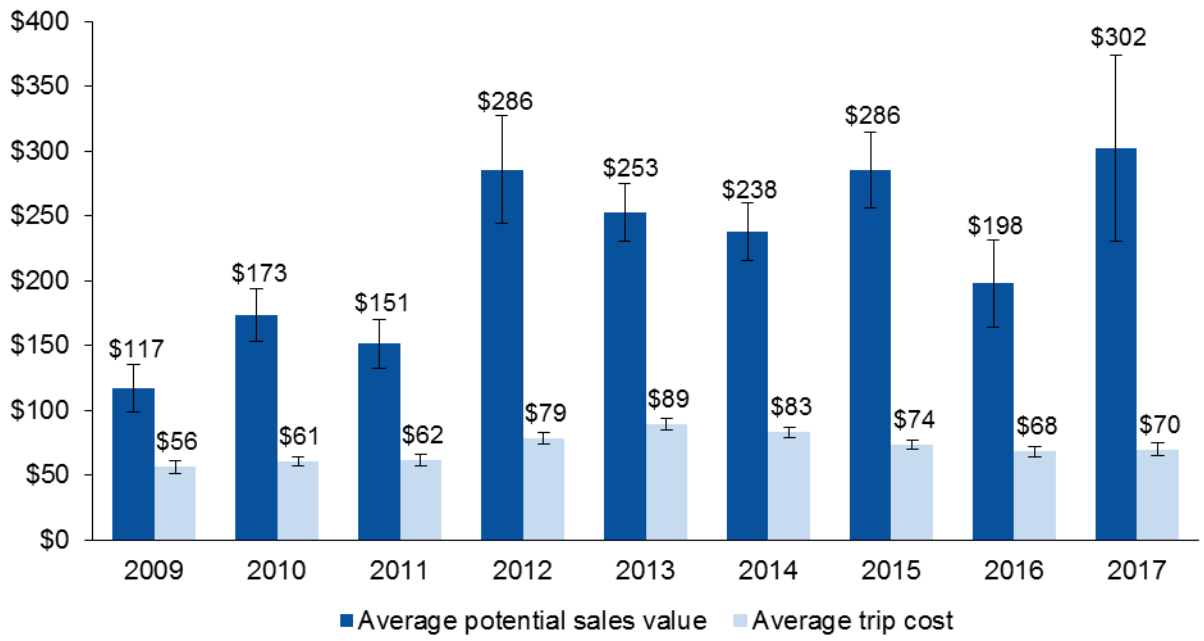


**Figure 34. Average potential sales value, average trip costs*, and standard errors (shown by blankets) for all gear types, CNMI small boat fishery, 2009–2017 (adjusted to 2017 dollars)**

*Note: annual trip costs are slightly different from Figure 26 due to some trips with no disposition records and therefore no sales value, which were eliminated from this analysis.

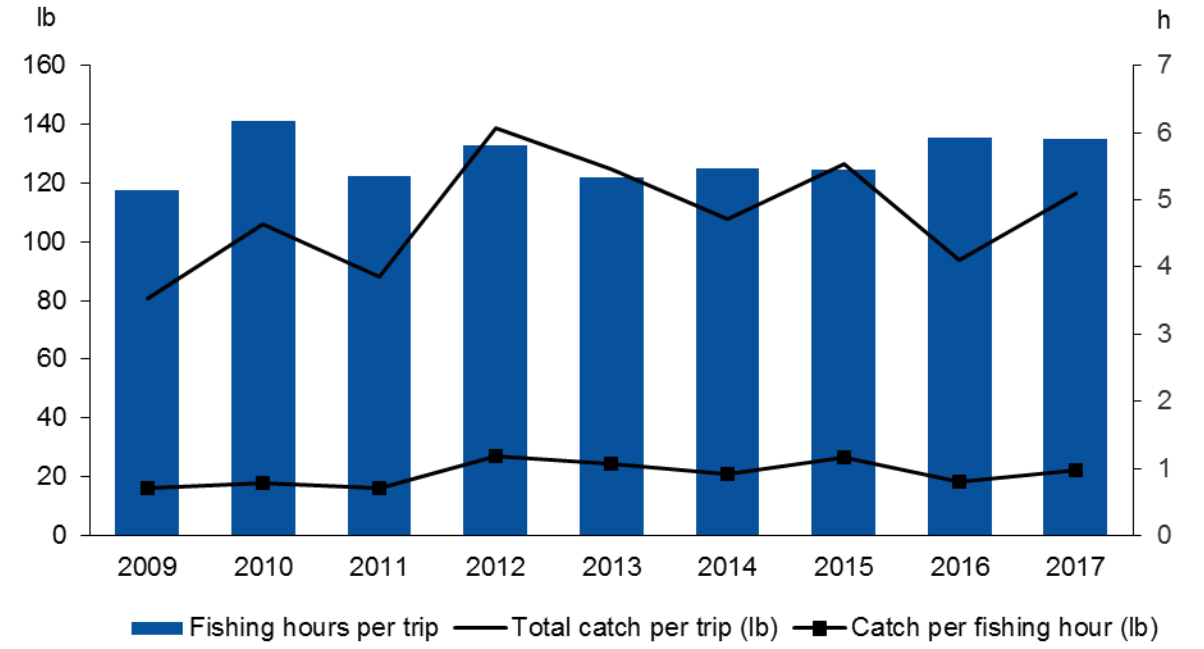


**Figure 35. Average total catch per trip, fishing hours per trip, and catch per fishing hour for all gear types, CNMI small boat fishery, 2009–2017**

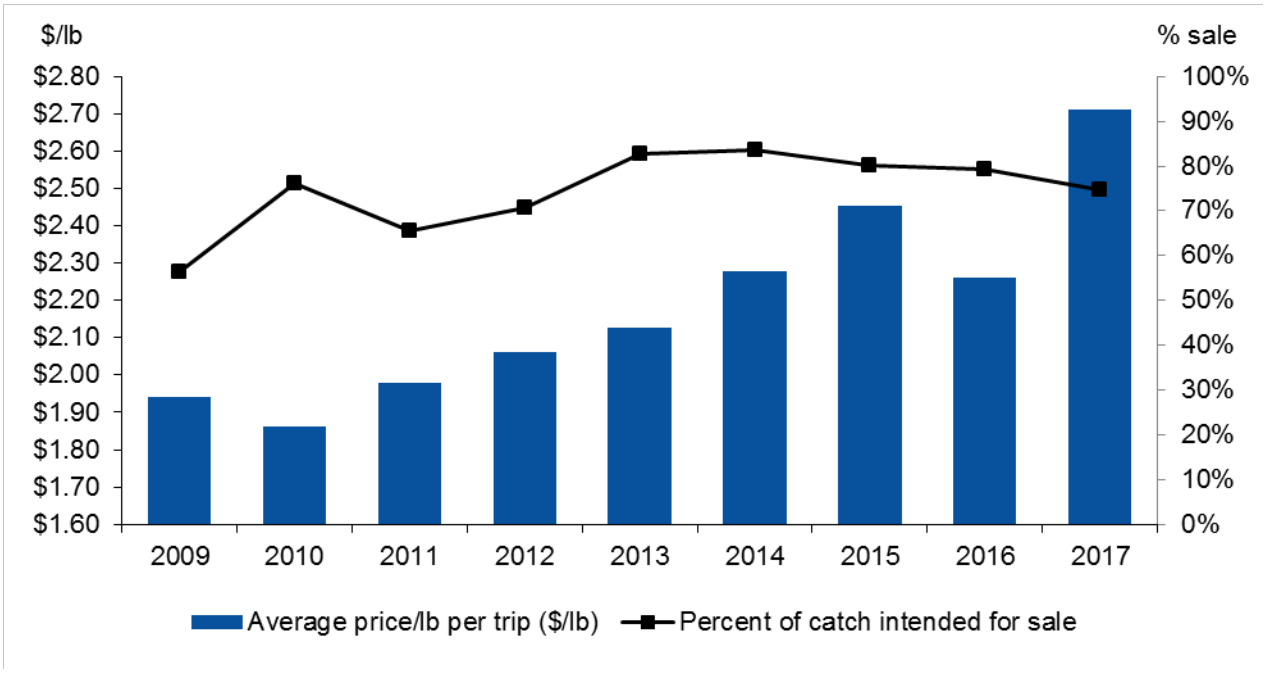


**Figure 36. Percent of catch intended for sale per trip, and average fish price per pound for all gear types, CNMI small boat fishery, 2009–2017 (adjusted to 2017 dollars)**

### *CNMI Potential Sales Value of Fishing Trip by Gear Type*

Potential sales values vary greatly by gear type in the CNMI small boat fishery due to different catch levels per trip, percent of catch intended for sale, and fish prices. Troll trips in general had higher potential sales values due to high catch per trip and high percent of catch intended for sale (88% between 2009 and 2017). For bottomfish trips, although the bottomfish fish prices were the highest across species, the low percent of the catch intended for sale (26% between 2009 and 2017) and the low catch per trip made the potential sales value relatively low, except in 2017 when a few high-catch trips produced a potential sales value of $640. Table 19 shows the average per-trip potential sales value, potential net revenue, catch, fishing hours, and fish price per pound by gear and year.

**Table 19. Potential sales value, potential net revenue, catch, fishing hours, and fish price per pound, on average per trip and by gear and year, CNMI small boat fishery (adjusted to 2017 dollars)**

| Gear | Year | *Number of interviews (n)* | Potential sales value ($) | Potential net revenue ($) | Catch (lb) | Fishing hours (h) | Fish price/lb ($) |
|---|---|---|---|---|---|---|---|
| Troll | 2009 | 40 | 170 | 93 | 109 | 5.4 | 1.76 |
| Troll | 2010 | 67 | 218 | 146 | 131 | 6.4 | 1.77 |
| Troll | 2011 | 67 | 193 | 114 | 113 | 5.6 | 1.89 |
| Troll | 2012 | 109 | 286 | 198 | 155 | 5.4 | 1.94 |
| Troll | 2013 | 118 | 278 | 181 | 138 | 5.2 | 2.07 |
| Troll | 2014 | 133 | 265 | 173 | 120 | 5.6 | 2.25 |
| Troll | 2015 | 78 | 312 | 232 | 141 | 5.5 | 2.34 |
| Troll | 2016 | 55 | 189 | 119 | 94 | 5.8 | 2.16 |
| Troll | 2017 | 52 | 257 | 183 | 113 | 5.9 | 2.65 |
| Bottomfish | 2009 | 15 | 58 | 19 | 57 | 5.0 | 3.29 |
| Bottomfish | 2010 | 17 | 27 | 7 | 21 | 5.2 | 2.94 |
| Bottomfish | 2011 | 20 | 14 | (5) | 15 | 3.9 | 3.33 |
| Bottomfish | 2012 | 23 | 387 | 328 | 109 | 8.4 | 3.70 |
| Bottomfish | 2013 | 15 | 164 | 96 | 64 | 6.4 | 3.09 |
| Bottomfish | 2014 | 16 | 48 | 26 | 18 | 4.4 | 5.40 |
| Bottomfish | 2015 | 11 | 150 | 114 | 39 | 5.4 | 4.39 |
| Bottomfish | 2016 | 12 | 270 | 204 | 104 | 6.8 | 3.02 |
| Bottomfish | 2017 | 7 | 640 | 602 | 141 | 5.7 | 3.54 |
| Spear/snorkel | 2009 | 10 | 30 | 16 | 27 | 5.0 | 2.84 |
| Spear/snorkel | 2010 | * | * | * | * | * | * |
| Spear/snorkel | 2011 | 4 | 88 | 78 | 38 | 5.8 | 2.47 |
| Spear/snorkel | 2012 | 6 | 11 | 2 | 15 | 4.6 | 2.57 |
| Spear/snorkel | 2013 | 3 | 17 | 10 | 23 | 5.8 | 2.81 |
| Spear/snorkel | 2014 | * | * | * | * | * | * |
| Spear/snorkel | 2015 | * | * | * | * | * | * |
| Spear/snorkel | 2016 | 0 | - | - | - | - | - |
| Spear/snorkel | 2017 | 0 | - | - | - | - | - |
| Mixed troll and bottomfish | 2009 | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2010 | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2011 | 6 | 283 | 206 | 136 | 7.6 | 2.22 |
| Mixed troll and bottomfish | 2012 | 3 | 439 | 356 | 181 | 8.8 | 2.40 |
| Mixed troll and bottomfish | 2013 | 5 | 225 | 138 | 129 | 7.0 | 2.28 |
| Mixed troll and bottomfish | 2014 | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2015 | 0 | - | - | - | - | - |
| Mixed troll and bottomfish | 2016 | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2017 | 0 | - | - | - | - | - |
| Atulai | 2009 | 5 | 26 | 4 | 19 | 3.0 | 2.63 |
| Atulai | 2010 | 0 | - | - | - | - | - |
| Atulai | 2011 | * | * | * | * | * | * |
| Atulai | 2012 | * | * | * | * | * | * |
| Atulai | 2013 | 3 | 0 | (4) | 8 | 1.8 | ** |
| Atulai | 2014 | 0 | - | - | - | - | - |
| Atulai | 2015 | * | * | * | * | * | * |
| Atulai | 2016 | 0 | - | - | - | - | - |
| Atulai | 2017 | 0 | - | - | - | - | - |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented. ** No sales.

## CNMI Sub-fisheries

For the sampling period of 2009–2017, pelagic trips had the highest potential sales values and net revenues despite also having the highest trip costs across the sub-fisheries. Bottomfish trips had about half of the potential sales values as the pelagic trips. Reef-fish trips had the lowest potential sales values but also had the lowest trip costs. Figure 37 shows the average per-trip potential sales value, cost, and the respective standard error of each mean by sub-fishery for 2009 to 2017. Appendix Table D11 shows the fishing trip costs by sub-fishery, and Appendix Table D12 shows the fishing trip costs and fuel-cost share by category, sub-fishery, and year.

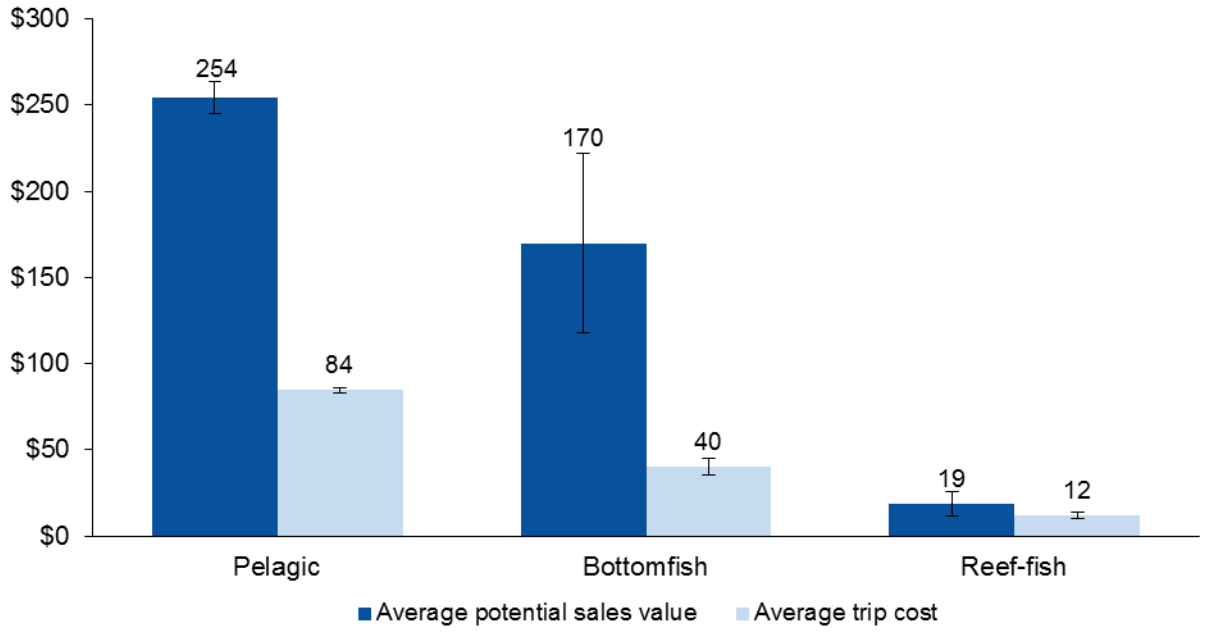


**Figure 37. Average potential sales value, average trip costs, and standard errors (shown by blankets) by sub-fishery, CNMI small boat fishery, 2009–2017 (adjusted to 2017 dollars)**

Pelagic trips had the highest potential sales value and potential net revenue for most of the years due to high catch per trip, despite average fish prices being lower and trip costs being higher than other sub-fisheries. Bottomfish trips had the highest potential sales value and potential net revenue in 2012, 2016, and 2017, mainly due to high bottomfish prices and higher catch in 2016 and 2017. Reef-fish trips had the lowest catch across years, and therefore the lowest potential sales value and potential net revenue. Table 20 shows average per-trip potential sales value, trip cost, potential net revenue, catch, fishing hours, and fish price per pound by fishery and year.

**Table 20. Potential sales value, trip cost, potential net revenue, catch, fishing hours, and fish price per pound, on average per trip and by fishery and year, CNMI small boat fishery (adjusted to 2017 dollars)**

| Sub-fishery | Year | *Number of interviews (n)* | Potential sales value ($) | Trip cost ($) | Potential net revenue ($) | Catch (lb) | Fishing hours (h) | Fish price/lb ($) |
|---|---|---|---|---|---|---|---|---|
| Pelagic | 2009 | 40 | 170 | 77 | 93 | 109 | 5.4 | 1.76 |
| Pelagic | 2010 | 67 | 218 | 73 | 146 | 131 | 6.4 | 1.77 |
| Pelagic | 2011 | 66 | 196 | 80 | 116 | 115 | 5.7 | 1.89 |
| Pelagic | 2012 | 109 | 286 | 88 | 198 | 155 | 5.4 | 1.94 |
| Pelagic | 2013 | 118 | 278 | 96 | 181 | 138 | 5.2 | 2.07 |
| Pelagic | 2014 | 132 | 267 | 92 | 175 | 121 | 5.6 | 2.25 |
| Pelagic | 2015 | 78 | 312 | 80 | 232 | 141 | 5.5 | 2.34 |
| Pelagic | 2016 | 53 | 196 | 71 | 124 | 97 | 5.9 | 2.16 |
| Pelagic | 2017 | 51 | 262 | 75 | 186 | 115 | 6.0 | 2.65 |
| Bottomfish | 2009 | 15 | 58 | 39 | 19 | 57 | 5.0 | 3.29 |
| Bottomfish | 2010 | 17 | 27 | 20 | 7 | 21 | 5.2 | 2.94 |
| Bottomfish | 2011 | 20 | 14 | 19 | (5) | 15 | 3.9 | 3.33 |
| Bottomfish | 2012 | 23 | 387 | 59 | 328 | 109 | 8.4 | 3.70 |
| Bottomfish | 2013 | 15 | 164 | 68 | 96 | 64 | 6.4 | 3.09 |
| Bottomfish | 2014 | 16 | 48 | 22 | 26 | 18 | 4.4 | 5.40 |
| Bottomfish | 2015 | 11 | 150 | 36 | 114 | 39 | 5.4 | 4.39 |
| Bottomfish | 2016 | 12 | 270 | 66 | 204 | 104 | 6.8 | 3.02 |
| Bottomfish | 2017 | 7 | 640 | 38 | 602 | 141 | 5.7 | 3.54 |
| Coral reef | 2009 | 16 | 27 | 16 | 11 | 28 | 4.4 | 2.79 |
| Coral reef | 2010 | * | * | * | * | * | * | * |
| Coral reef | 2011 | 8 | 44 | 9 | 35 | 25 | 4.9 | 2.47 |
| Coral reef | 2012 | 8 | 9 | 8 | 1 | 11 | 3.7 | 2.57 |
| Coral reef | 2013 | 6 | 9 | 6 | 3 | 15 | 3.8 | 2.81 |
| Coral reef | 2014 | 3 | 0 | 11 | (11) | 12 | 3.7 | - |
| Coral reef | 2015 | * | * | * | * | * | * | * |
| Coral reef | 2016 | * | * | * | * | * | * | * |
| Coral reef | 2017 | * | * | * | * | * | * | * |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

## Discussion

This report presents economic performance indicators for small boat fisheries in American Samoa, Guam, and the CNMI from 2009 to 2017. The trip cost data were collected through the PIFSC continuous economic data collection programs' add-on to the creel surveys in the island areas and include fuel use, fuel price, cost of ice, bait and chum, and gear lost. The trip cost survey connected to the ongoing creel survey component enables trip cost data to be collected routinely, while also allowing for the calculation of potential trip sales value and potential net revenue. This report demonstrates that the small boat fisheries in American Samoa, Guam, and the CNMI comprise a mix of commercial and non-commercial fishermen, gear uses, and sub-fisheries, and shows how the fisheries differ economically in these respects. This information can be useful to fisheries managers when evaluating the potential economic impacts from future regulatory alternatives related to the fishery participants. The evaluation of the economic performance of the small boat fisheries is important because of its diverse economic effects on fishermen and local economies, as reflected in the catch disposition patterns. Bottomfish caught in Guam from solely bottomfish trips were mostly intended for self-consumption or shared with friends or family, while in American Samoa over 90% of landings were reported to be intended for sale. Any future regulatory alternatives will have different impacts on the fisheries and their communities, both economically and culturally. By evaluating the economic performance of these fisheries over time, factors that contribute to trip cost variations can be tracked. As demonstrated in the American Samoa small boat fishery, a government fuel subsidy program had direct impacts on fuel costs and fuel usage, and possible indirect impacts on fishing effort. In addition, net revenue can be used to assess and project the dynamics of the fishing effort in the short term and the stability of these fisheries in the long term. By evaluating economic performance by the additional factors of gear type and sub-fishery, the study can be used to conduct regulatory impact analysis in specific gear or sub-fishery level.

There are, however, some limitations in this study. First is the limitation in the types of data collected. The continuous data collection programs only focus on trip expenditure while missing annual fishing fixed costs, i.e., the costs incurred regardless of the number of trips taken in a year. Some episodic cost-earnings surveys of the small boat fisheries in CNMI (Hospital and Beavers 2014) and Guam (Hospital and Beavers 2012) captured not only average trip costs, but also fixed expenditures. Since their surveys were conducted in a setting with flexible time frame, their studies were able to capture representative sample and provided reliable fixed cost information. Second limitation of this study is we calculated the potential sales value, instead of actual sales value, of the catch to estimate trip net revenue. The potential sales value would be different from the actual sales value if the catch intended for sale was not realized. Yet, this is the only data source of fish value available at the trip level in the three island areas. Although commercial landings data are collected through the "commercial sales receipt book" programs in these three island areas, the quality of commercial landings data varies across years and areas due to the nature of the program designs. The "commercial sales receipt book" programs were not a census and might not be consistent across years. Also, they do not capture data at an individual trip level. The third limitation of this study is no economic value is assigned to the catch retained for home consumption, sharing, and bartering. This is because the disposition of catch other than commercial sale, such as home consumption and from socio-cultural motivations, requires alternative methodologies to assign an accurate economic value which is outside the scope of the PIFSC continuous economic monitoring programs.

## Acknowledgements

We want to thank many people who contributed to the success of this study. First and most importantly, we would like to thank all the fishermen who participated in this trip cost survey. Without their participation, we would not have been able to capture the economic information. We very much appreciate all the hard work provided by the local fisheries staff in the American Samoa Department of Marine and Wildlife Resources (DMWR), the Guam Department of Agriculture's Division of Aquatic and Wildlife Resources (DAWR), and the CNMI Department of Lands and Natural Resources' Division of Fish & Wildlife (DFW). They tirelessly intercepted and interviewed the fishermen, sometimes in hot and wet weather conditions, early in the morning, and late at night. We also want to thank the staff in the WPacFIN who provided technical support to the local fisheries staff, ensured the quality of the data, and provided the economic data to us on a regular basis. We also want to thank Emily Rollins who created a computer program to link the creel species data with fish price data and thus enabled us to easily calculate potential sales values.

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# Appendices

## Appendix A. Survey Questionnaire

Note: The trip cost add-on was incorporated into the survey form.

### *A1. American Samoa Survey Form*

☐ Opportunistic.
☐ Interview not completed.

Page (____/____)

**Department of Marine and Wildlife Resources**
**Boat-based Survey Boat Log (Participation)**

**Date:** _____
**Type Day:** (1)WD (2)WE/H

**Interview Time:** _____ **Interview #:** _____ **Charter** (Y/N): _____ **Port:** _____
**Boat/Name:**_____ **Reg. Number:**_____ **# of Fishers:** _____

**CATCH EFFORT DATA FOR ONE FISHING METHOD:**

**Method** (circle one):
(2) - Troll
(4) - Bottom
(5) - Troll/Bottom
(6) - Spear (Free Dive)
(8) -Atule-mix
(16) - Longline
(62) - Other: _____

**Trip Begin Date/Time:** _____@ ____
**Number of Gears:**_____
**Hours Fished:**_____
**Days Fished:**_____
**Total Trip Pounds:** _____
**Area Fished:** _____
**Home Island:** Tutuila / Manu`a / Aunu`u

| **For Longlining:** |
|---|
| # Set: |
| # Hours per set: |
| # Hooks per set: |

| **Trip Cost Information** | | |
|---|---|---|
| Gallons of fuel used | | Gal. |
| Price per gallon | $ | |
| Cost of ice used | $ | ☐ free |
| Cost of bait & chum used | $ | |
| Cost of fishing gear lost | $ | |
| Engine type | 2s / 4s / Diesel | |

Landed Condition code: W: Whole fish, 1:GG, 2: HG, 3:GHT, 4:Gutted, 5: Headed, 6: Sharbite

| Species Name | Length (Cm) | Species weight (Pounds) | Number Pieces | Landed Condition | Disposition | $ / Lb | Comments |
|---|---|---|---|---|---|---|---|
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| BY-CATCH (Fish that released or discarded): YES / NO (write LIVE or DEAD/INJURED in Disposition) | | | | | | | |
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Captain's/Crew's Signature:_____

Rev: July 20, 2012

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## *A2. Guam Survey Form*

Fisheries Section
Division of Aquatic and Wildlife Resources
Department of Agriculture, Guam
OFFSHORE CREEL CENSUS FORM

Date _____1 WD/2 WE
Landing_____

Interview #_____
Interviewer _____
Interview Time _____

Boat #_____ Charter? (y/n/u)_____Berthed (y/n/u) _____Towing Vehicle's License #_____

| Method | Gear Units | Hours fished | Area Fished |
|---|---|---|---|
| 1. Trolling | | | |
| 2. Bottom (s,d,m) | | | |
| 3. Atulai night jigging | | | |
| 4. Snorkel Spearfishing | | | |
| 5. Scuba Spearfishing | | | |
| 6. Other_____ | | | |
| 7. Other_____ | | | |

No. of people on board _____
No. of guests (charter only)_____

Weather _____Cloud cover_____
Wind Direction _____Speed_____
Tropical Storm/Typhoon condition_____
Warnings: Small craft _____ (y,n,u)
High Surf _____(y,n,u)

| Species/Code | Length (mm) | Wt. (kg) | Length (mm) | Wt. (kg) | Length (mm) | Wt. (kg) | Total Actual | No. Est. | Total Actual | Weight Calc. | Est. | Price per lb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
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Bycatch: Did you release or throw back any fish? ( ) NO ( ) Yes (if yes, list below)

| Species/Code | Method | Check Released dead | One Released alive | Length (mm) | Wt. (kg) | Length (mm) | Wt. (kg) | Total Act. | Number Est. | Total Actual | Weight Calc. | Est. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
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Catch Disposition

| Method | % not sold | % sold | Buyer |
|---|---|---|---|
| | | | |
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REMARKS:

Trip Cost Information Refused Yes No

| | |
|---|---|
| Fuel cost for **this trip** | $ |
| Gallons of fuel **used** | Gal. |
| Price per gallon | $ |
| Cost of ice used | $ |
| Cost of bait & chum used | $ |
| Cost of fishing gear lost | $ |
| Engine type | 2s 4s Diesel |

Revised 2011/09/21

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## A3. CNMI Survey Form

### Saipan Boat-Based Interview Form

**Opportunistic Interview:** Y N

**Interview #** _____ **Time:** _____

**Date:** _____ WD WE/H **Interviewer:** _____

**Location/Port:** _____ **Charter:** Y N **Berthed:** Y N

**( SD-8 / FB-14 / SCM-18)** **# people:** _____ **# guests:** _____

Boat name/# : _____

Towing vehicle lic. # : _____ **Weather:** _____

| Method | Gear Units | Hrs. Fished | Area(s) fished | % Sold dockside | % Sold store | % Unsold |
|---|---|---|---|---|---|---|
| Trolling (1) | | | | | | |
| Bottom S D M U (2) | | | | | | |
| Atulai (3) | | | | | | |
| Spear/Snorkel (4) | | | | | | |
| Spear/Scuba (5) | | | | | | |
| Other (specify) (20) | | | | | | |
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**By Catch :** Y N

**Bycatch Information**

**Species ID:**_____

# pcs. Released: _____

# Live: _____ # Dead: _____

**Species ID:**_____

# pcs. Released: _____

# Live: _____ # Dead: _____

| SPECIES/Code | Length (cm.mm) | Weight (kg.) | Length (cm.mm) | Weight (kg.) | Total Number Act.(1) | Total Number Est.(3) | Total Weight Act.(1) | Total Weight Calc.(2) | Total Weight Est.(3) | Price per lb |
|---|---|---|---|---|---|---|---|---|---|---|
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| Trip Cost Information | | |
|---|---|---|
| Gallons of fuel used | gal. | |
| Price per gallon | $ | |
| Cost of ice used | $ | |
| Cost of bait & chum used | $ | |
| Cost of fishing gear losted | $ | |
| Engine type | 2s 4s Diesel | |
| GPS | Y | N |
| Fish finder | Y | N |
| Electric/Hydrolic Gears | Y | N |

| FAD Information | | | |
|---|---|---|---|
| FAD # | # hrs. | # pieces | Species |
| | | | |
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## Appendix B. Creel Survey: Boat-Based Interview Sampling Location and Time

| | Minimum Survey Days per Month | Shift: Day | Shift: Night |
|---|---|---|---|
| **AMERICAN SAMOA** | | | |
| Pago Pago, Fagatogo, Utulei, Faga'alu | 12 weekdays and 2 weekends/holidays | 6:00-12:00 | 15:00-21:00 |
| **GUAM** | | | |
| Agana Boat Basin | 2 weekdays, 2 weekends/holidays | 5:00-12:00 | 16:00-24:00 |
| Agat Harbor | 1 weekday, 1 weekend/holiday | 5:30-12:00 | 16:00-24:00 |
| Merizo Pier | 1 weekday, 1 weekend/holiday | 6:00-11:00 | 16:00-24:00 |
| **CNMI** | | | |
| Sugar Dock, Fishing Base, Smiling Cove | 9 weekends and 9 weekdays/holidays (per quarter) | 10:01-14:00 | 20:00-22:00 |

Sources: NOAA PIFSC, Guam Boat-based Creel Survey Documentation, 2011, unpublished. NOAA PIFSC, Saipan Boat-based Creel Survey Documentation, 2011, unpublished. NOAA PIFSC, American Samoa Boat-based Creel Survey Documentation, 2011, unpublished.

## Appendix C. Consumer Price Index

| | American Samoa | Guam | CNMI |
|---|---|---|---|
| 2009 | 248.27 | 759.80 | 352.50 |
| 2010 | 260.19 | 781.80 | 371.90 |
| 2011 | 281.27 | 807.60 | 380.50 |
| 2012 | 290.55 | 833.40 | 384.70 |
| 2013 | 296.36 | 833.50 | 375.10 |
| 2014 | 298.43 | 840.20 | 379.20 |
| 2015 | 295.75 | 832.60 | 363.70 |
| 2016 | 295.45 | 882.60 | 371.30 |
| 2017 | 301.66 | 904.70 | 371.30 |

Sources: American Samoa CPI: American Samoa Government Department of Commerce. Guam CPI: Bureau of Statistics and Plans Business and Economic Statistics Program, Government of Guam. The CNMI CPI: computed by the CNMI Department of Commerce using the Laspeyres' formula.

## Appendix D. Summary Tables

**Table D 1. Fishing trip costs by gear and year (mean, standard error, and median), American Samoa small boat fishery (adjusted to 2017 dollars)**

| Gear | Year | *Number of interviews (n)* | Mean | Standard error | Median |
|---|---|---|---|---|---|
| Bottomfish | 2009 | 5 | 137.30 | 26.41 | 132.44 |
| Bottomfish | 2010 | 25 | 130.32 | 12.28 | 140.87 |
| Bottomfish | 2011 | 47 | 114.21 | 5.86 | 127.20 |
| Bottomfish | 2012 | 12 | 91.05 | 11.27 | 93.65 |
| Bottomfish | 2013 | 31 | 135.26 | 8.97 | 142.91 |
| Bottomfish | 2014 | 98 | 112.61 | 5.29 | 103.84 |
| Bottomfish | 2015 | 102 | 101.09 | 4.03 | 91.80 |
| Bottomfish | 2016 | 51 | 121.95 | 6.84 | 122.52 |
| Bottomfish | 2017 | 59 | 125.45 | 6.44 | 116.50 |
| Spear | 2009 | 6 | 26.83 | 4.31 | 26.11 |
| Spear | 2010 | 46 | 63.20 | 3.97 | 59.48 |
| Spear | 2011 | 55 | 61.34 | 2.61 | 67.08 |
| Spear | 2012 | * | * | * | * |
| Spear | 2013 | 50 | 82.14 | 3.71 | 73.24 |
| Spear | 2014 | 61 | 64.16 | 3.77 | 61.91 |
| Spear | 2015 | 25 | 71.94 | 3.41 | 71.40 |
| Spear | 2016 | 30 | 57.15 | 3.80 | 52.97 |
| Spear | 2017 | 25 | 54.65 | 5.42 | 45.00 |
| Troll | 2009 | * | * | * | * |
| Troll | 2010 | * | * | * | * |
| Troll | 2011 | 32 | 91.55 | 5.25 | 89.66 |
| Troll | 2012 | 19 | 86.00 | 9.87 | 85.86 |
| Troll | 2013 | 34 | 89.43 | 6.41 | 92.02 |
| Troll | 2014 | 65 | 69.34 | 4.33 | 69.75 |
| Troll | 2015 | 40 | 81.63 | 5.74 | 80.32 |
| Troll | 2016 | 35 | 76.76 | 5.65 | 84.23 |
| Troll | 2017 | 34 | 102.26 | 5.26 | 102.25 |
| Mixed troll and bottomfish | 2009 | * | * | * | * |
| Mixed troll and bottomfish | 2010 | * | * | * | * |
| Mixed troll and bottomfish | 2011 | 19 | 143.27 | 12.21 | 161.68 |
| Mixed troll and bottomfish | 2012 | * | * | * | * |
| Mixed troll and bottomfish | 2013 | 7 | 149.01 | 10.32 | 156.86 |
| Mixed troll and bottomfish | 2014 | 31 | 96.58 | 7.39 | 96.03 |
| Mixed troll and bottomfish | 2015 | 31 | 127.41 | 10.67 | 112.20 |
| Mixed troll and bottomfish | 2016 | 42 | 118.67 | 6.31 | 108.74 |
| Mixed troll and bottomfish | 2017 | 6 | 97.84 | 17.88 | 97.13 |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

**Table D 2. Fishing trip costs and fuel cost share by category, gear, and year, American Samoa small boat fishery (adjusted to 2017 dollars)**

| Gear | Year | *Number of interviews (n)* | Fuel use (gallons) | Fuel price ($/gallon) | Fuel ($) | Ice ($) | Bait & chum ($) | Gear lost ($) | Total trip cost ($) | Fuel cost share (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Bottomfish | 2009 | 5 | 17.00 | 3.71 | 62.70 | - | 41.80 | 32.81 | 137.30 | 46 |
| Bottomfish | 2010 | 25 | 21.02 | 3.92 | 82.65 | - | 27.83 | 19.85 | 130.32 | 63 |
| Bottomfish | 2011 | 47 | 19.55 | 4.35 | 84.26 | - | 18.10 | 11.85 | 114.21 | 74 |
| Bottomfish | 2012 | 12 | 12.83 | 4.35 | 55.58 | 16.87 | 15.14 | 14.71 | 91.05 | 61 |
| Bottomfish | 2013 | 31 | 19.81 | 4.37 | 85.67 | 23.62 | 14.02 | 11.95 | 135.26 | 63 |
| Bottomfish | 2014 | 98 | 29.67 | 2.57 | 69.71 | 19.66 | 20.89 | 2.35 | 112.61 | 62 |
| Bottomfish | 2015 | 102 | 35.25 | 2.03 | 69.22 | 15.06 | 12.67 | 4.13 | 101.09 | 68 |
| Bottomfish | 2016 | 51 | 28.84 | 2.25 | 64.33 | 23.96 | 16.74 | 16.92 | 121.95 | 53 |
| Bottomfish | 2017 | 59 | 32.53 | 2.28 | 72.64 | 28.64 | 14.51 | 9.66 | 125.45 | 58 |
| Spear | 2009 | 6 | 7.00 | 3.85 | 26.83 | - | 0.00 | 0.00 | 26.83 | 100 |
| Spear | 2010 | 46 | 16.09 | 3.93 | 63.20 | - | 0.00 | 0.00 | 63.20 | 100 |
| Spear | 2011 | 55 | 13.83 | 4.44 | 61.34 | - | 0.00 | 0.00 | 61.34 | 100 |
| Spear | 2012 | * | * | * | * | * | * | * | * | * |
| Spear | 2013 | 50 | 14.90 | 4.38 | 65.32 | 17.50 | 0.20 | 0.51 | 82.14 | 80 |
| Spear | 2014 | 61 | 22.93 | 2.46 | 50.70 | 12.46 | 0.50 | 0.50 | 64.16 | 79 |
| Spear | 2015 | 25 | 31.40 | 1.84 | 57.58 | 12.89 | 1.47 | 0.00 | 71.94 | 80 |
| Spear | 2016 | 30 | 17.30 | 1.99 | 34.14 | 18.85 | 0.10 | 4.05 | 57.15 | 60 |
| Spear | 2017 | 25 | 19.40 | 2.05 | 40.31 | 14.34 | 0.00 | 0.00 | 54.65 | 74 |
| Troll | 2009 | * | * | * | * | * | * | * | * | * |
| Troll | 2010 | * | * | * | * | * | * | * | * | * |
| Troll | 2011 | 32 | 18.97 | 4.60 | 86.86 | - | 0.00 | 4.69 | 91.55 | 95 |
| Troll | 2012 | 19 | 16.11 | 4.43 | 71.52 | 11.87 | 0.00 | 10.11 | 86.00 | 83 |
| Troll | 2013 | 34 | 16.00 | 4.31 | 69.10 | 14.77 | 0.00 | 5.99 | 89.43 | 77 |
| Troll | 2014 | 65 | 29.31 | 2.16 | 59.60 | 5.07 | 2.49 | 2.18 | 69.34 | 86 |
| Troll | 2015 | 40 | 31.50 | 2.20 | 64.65 | 14.94 | 0.00 | 2.04 | 81.63 | 79 |
| Troll | 2016 | 35 | 23.31 | 2.31 | 50.01 | 19.20 | 0.58 | 6.97 | 76.76 | 65 |
| Troll | 2017 | 34 | 33.03 | 2.40 | 78.76 | 20.21 | 0.94 | 2.35 | 102.26 | 77 |
| Mixed troll and bottomfish | 2009 | * | * | * | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2010 | * | * | * | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2011 | 19 | 25.53 | 4.29 | 110.25 | - | 19.19 | 13.83 | 143.27 | 77 |
| Mixed troll and bottomfish | 2012 | * | * | * | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2013 | 7 | 26.43 | 4.40 | 117.02 | 20.36 | 10.18 | 1.45 | 149.01 | 79 |
| Mixed troll and bottomfish | 2014 | 31 | 30.42 | 2.20 | 63.44 | 9.50 | 20.38 | 3.26 | 96.58 | 66 |
| Mixed troll and bottomfish | 2015 | 31 | 42.58 | 2.35 | 96.32 | 15.79 | 9.38 | 5.92 | 127.41 | 76 |
| Mixed troll and bottomfish | 2016 | 42 | 34.00 | 2.01 | 68.25 | 29.54 | 10.06 | 10.82 | 118.67 | 58 |
| Mixed troll and bottomfish | 2017 | 6 | 32.50 | 2.19 | 65.68 | 25.17 | 7.00 | 0.00 | 97.84 | 67 |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

**Table D 3. Fishing trip costs by sub-fishery and year (mean, standard error, and median), American Samoa small boat fishery (adjusted to 2017 dollars)**

| Sub-fishery | Year | *Number of interviews (n)* | Mean | Standard error | Median |
|---|---|---|---|---|---|
| Pelagic | 2009 | * | * | * | * |
| Pelagic | 2010 | * | * | * | * |
| Pelagic | 2011 | 36 | 104.29 | 8.58 | 92.23 |
| Pelagic | 2012 | 19 | 86.00 | 9.87 | 85.86 |
| Pelagic | 2013 | 42 | 94.23 | 5.54 | 96.60 |
| Pelagic | 2014 | 127 | 84.88 | 3.28 | 79.60 |
| Pelagic | 2015 | 80 | 94.55 | 4.71 | 80.32 |
| Pelagic | 2016 | 52 | 89.98 | 5.13 | 92.53 |
| Pelagic | 2017 | 37 | 102.01 | 5.02 | 100.00 |
| Bottomfish | 2009 | 5 | 137.30 | 26.41 | 132.44 |
| Bottomfish | 2010 | 25 | 130.32 | 12.28 | 140.87 |
| Bottomfish | 2011 | 47 | 114.21 | 5.86 | 127.20 |
| Bottomfish | 2012 | 12 | 91.05 | 11.27 | 93.65 |
| Bottomfish | 2013 | 31 | 135.26 | 8.97 | 142.91 |
| Bottomfish | 2014 | 98 | 112.61 | 5.29 | 103.84 |
| Bottomfish | 2015 | 102 | 101.09 | 4.03 | 91.80 |
| Bottomfish | 2016 | 51 | 121.95 | 6.84 | 122.52 |
| Bottomfish | 2017 | 59 | 125.45 | 6.44 | 116.50 |
| Coral reef | 2009 | 6 | 26.83 | 4.31 | 26.11 |
| Coral reef | 2010 | 47 | 62.64 | 3.92 | 59.48 |
| Coral reef | 2011 | 55 | 61.34 | 2.61 | 67.08 |
| Coral reef | 2012 | * | * | * | * |
| Coral reef | 2013 | 50 | 82.14 | 3.71 | 73.24 |
| Coral reef | 2014 | 61 | 64.16 | 3.77 | 61.91 |
| Coral reef | 2015 | 26 | 71.36 | 3.33 | 71.40 |
| Coral reef | 2016 | 31 | 55.91 | 3.88 | 52.33 |
| Coral reef | 2017 | 25 | 54.65 | 5.42 | 45.00 |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

**Table D 4. Fishing trip costs and fuel cost share by category, sub-fishery, and year, American Samoa small boat fishery (adjusted to 2017 dollars)**

| Sub-fishery | Year | *Number of interviews (n)* | Fuel use (gallons) | Fuel price ($/gallon) | Fuel ($) | Ice ($) | Bait & chum ($) | Gear lost ($) | Total trip cost ($) | Fuel cost share (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Pelagic | 2009 | * | * | * | * | * | * | * | * | * |
| Pelagic | 2010 | * | * | * | * | * | * | * | * | * |
| Pelagic | 2011 | 36 | 18.67 | 4.59 | 85.31 | - | 6.02 | 12.96 | 104.29 | 82 |
| Pelagic | 2012 | 19 | 16.11 | 4.43 | 71.52 | 11.87 | 0.00 | 10.11 | 86.00 | 83 |
| Pelagic | 2013 | 42 | 15.69 | 4.33 | 68.08 | 12.39 | 4.12 | 9.94 | 94.23 | 72 |
| Pelagic | 2014 | 127 | 34.20 | 2.05 | 66.33 | 3.07 | 14.05 | 1.43 | 84.88 | 78 |
| Pelagic | 2015 | 80 | 36.06 | 2.08 | 71.82 | 8.27 | 10.10 | 4.36 | 94.55 | 76 |
| Pelagic | 2016 | 52 | 26.85 | 2.14 | 53.59 | 20.03 | 10.49 | 5.87 | 89.98 | 60 |
| Pelagic | 2017 | 37 | 32.24 | 2.43 | 77.25 | 19.11 | 2.14 | 3.51 | 102.01 | 76 |
| Bottomfish | 2009 | 5 | 17.00 | 3.71 | 62.70 | - | 41.80 | 32.81 | 137.30 | 46 |
| Bottomfish | 2010 | 25 | 21.02 | 3.92 | 82.65 | - | 27.83 | 19.85 | 130.32 | 63 |
| Bottomfish | 2011 | 47 | 19.55 | 4.35 | 84.26 | - | 18.10 | 11.85 | 114.21 | 74 |
| Bottomfish | 2012 | 12 | 12.83 | 4.35 | 55.58 | 16.87 | 15.14 | 14.71 | 91.05 | 61 |
| Bottomfish | 2013 | 31 | 19.81 | 4.37 | 85.67 | 23.62 | 14.02 | 11.95 | 135.26 | 63 |
| Bottomfish | 2014 | 98 | 29.67 | 2.57 | 69.71 | 19.66 | 20.89 | 2.35 | 112.61 | 62 |
| Bottomfish | 2015 | 102 | 35.25 | 2.03 | 69.22 | 15.06 | 12.67 | 4.13 | 101.09 | 68 |
| Bottomfish | 2016 | 51 | 28.84 | 2.25 | 64.33 | 23.96 | 16.74 | 16.92 | 121.95 | 53 |
| Bottomfish | 2017 | 59 | 32.53 | 2.28 | 72.64 | 28.64 | 14.51 | 9.66 | 125.45 | 58 |
| Coral reef | 2009 | 6 | 7.00 | 3.85 | 26.83 | - | 0.00 | 0.00 | 26.83 | 100 |
| Coral reef | 2010 | 47 | 15.85 | 3.93 | 62.27 | - | 0.25 | 0.12 | 62.64 | 99 |
| Coral reef | 2011 | 55 | 13.83 | 4.44 | 61.34 | - | 0.00 | 0.00 | 61.34 | 100 |
| Coral reef | 2012 | * | * | * | * | * | * | * | * | * |
| Coral reef | 2013 | 50 | 14.90 | 4.38 | 65.32 | 17.50 | 0.20 | 0.51 | 82.14 | 80 |
| Coral reef | 2014 | 61 | 22.93 | 2.46 | 50.70 | 12.46 | 0.50 | 0.50 | 64.16 | 79 |
| Coral reef | 2015 | 26 | 31.15 | 1.83 | 57.08 | 12.87 | 1.41 | 0.00 | 71.36 | 80 |
| Coral reef | 2016 | 31 | 16.90 | 2.01 | 33.48 | 18.41 | 0.10 | 3.92 | 55.91 | 60 |
| Coral reef | 2017 | 25 | 19.40 | 2.05 | 40.31 | 14.34 | 0.00 | 0.00 | 54.65 | 74 |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

**Table D 5. Fishing trip costs by gear and year (mean, standard error, and median), Guam small boat fishery (adjusted to 2017 dollars)**

| Gear | Year | *Number of interviews (n)* | Mean | Standard error | Median |
|---|---|---|---|---|---|
| Troll | 2011 | 79 | 107.96 | 8.49 | 94.53 |
| Troll | 2012 | 52 | 126.10 | 15.67 | 93.38 |
| Troll | 2013 | 227 | 100.40 | 4.68 | 85.15 |
| Troll | 2014 | 126 | 108.81 | 6.53 | 92.25 |
| Troll | 2015 | 184 | 100.04 | 4.93 | 84.27 |
| Troll | 2016 | 101 | 78.39 | 6.99 | 63.86 |
| Troll | 2017 | 131 | 99.26 | 5.97 | 84.88 |
| Mixed troll and bottomfish | 2011 | 16 | 186.68 | 37.18 | 152.17 |
| Mixed troll and bottomfish | 2012 | 7 | 152.57 | 34.21 | 172.71 |
| Mixed troll and bottomfish | 2013 | 21 | 114.19 | 11.93 | 117.66 |
| Mixed troll and bottomfish | 2014 | 17 | 136.88 | 22.38 | 155.05 |
| Mixed troll and bottomfish | 2015 | 15 | 159.89 | 30.26 | 136.26 |
| Mixed troll and bottomfish | 2016 | 17 | 163.82 | 39.67 | 96.66 |
| Mixed troll and bottomfish | 2017 | 12 | 107.00 | 18.21 | 100.51 |
| Bottomfish | 2011 | * | * | * | * |
| Bottomfish | 2012 | 5 | 75.75 | 31.69 | 44.12 |
| Bottomfish | 2013 | 8 | 65.96 | 20.95 | 43.22 |
| Bottomfish | 2014 | 26 | 54.64 | 9.54 | 39.45 |
| Bottomfish | 2015 | 12 | 43.48 | 8.19 | 31.37 |
| Bottomfish | 2016 | 7 | 36.71 | 6.21 | 44.90 |
| Bottomfish | 2017 | 13 | 72.21 | 8.78 | 82.95 |
| Spear/snorkel | 2011 | * | * | * | * |
| Spear/snorkel | 2012 | * | * | * | * |
| Spear/snorkel | 2013 | * | * | * | * |
| Spear/snorkel | 2014 | 4 | 30.60 | 7.29 | 26.51 |
| Spear/snorkel | 2015 | 6 | 35.78 | 12.02 | 27.64 |
| Spear/snorkel | 2016 | 4 | 28.88 | 8.16 | 28.85 |
| Spear/snorkel | 2017 | 7 | 44.52 | 11.82 | 31.07 |
| Gillnet | 2011 | 0 | - | - | - |
| Gillnet | 2012 | 3 | 23.24 | 11.30 | 16.22 |
| Gillnet | 2013 | 9 | 25.00 | 8.12 | 15.85 |
| Gillnet | 2014 | 5 | 33.01 | 16.49 | 15.86 |
| Gillnet | 2015 | 3 | 8.91 | 2.60 | 9.75 |
| Gillnet | 2016 | * | * | * | * |
| Gillnet | 2017 | 0 | - | - | - |
| Mixed troll & spear/snorkel | 2011 | * | * | * | * |
| Mixed troll & spear/snorkel | 2012 | * | * | * | * |
| Mixed troll & spear/snorkel | 2013 | 3 | 42.39 | 12.43 | 45.50 |
| Mixed troll & spear/snorkel | 2014 | * | * | * | * |
| Mixed troll & spear/snorkel | 2015 | * | * | * | * |
| Mixed troll & spear/snorkel | 2016 | * | * | * | * |
| Mixed troll & spear/snorkel | 2017 | 5 | 74.88 | 20.63 | 51.96 |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

**Table D 6. Fishing trip costs and fuel cost share by category, gear, and year, Guam small boat fishery (adjusted to 2017 dollars)**

| Gear | Year | *Number of interviews (n)* | Fuel use (gallons) | Fuel price ($/gallon) | Fuel ($) | Ice ($) | Bait & chum ($) | Gear lost ($) | Total trip cost ($) | Fuel cost share (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Troll | 2011 | 79 | 15.79 | 5.13 | 80.90 | 11.58 | 4.59 | 10.89 | 107.96 | 75 |
| Troll | 2012 | 52 | 15.58 | 5.21 | 82.21 | 12.34 | 5.15 | 26.41 | 126.10 | 65 |
| Troll | 2013 | 227 | 13.28 | 5.18 | 68.49 | 12.48 | 0.94 | 18.48 | 100.40 | 68 |
| Troll | 2014 | 126 | 13.73 | 5.03 | 68.88 | 11.87 | 4.04 | 24.02 | 108.81 | 63 |
| Troll | 2015 | 184 | 12.48 | 4.16 | 52.05 | 11.75 | 7.70 | 28.54 | 100.04 | 52 |
| Troll | 2016 | 101 | 12.09 | 3.65 | 43.32 | 10.64 | 3.84 | 20.59 | 78.39 | 55 |
| Troll | 2017 | 131 | 12.21 | 3.82 | 46.53 | 19.81 | 9.56 | 23.35 | 99.26 | 47 |
| Mixed troll and bottomfish | 2011 | 16 | 26.34 | 5.13 | 135.97 | 13.18 | 15.47 | 22.05 | 186.68 | 73 |
| Mixed troll and bottomfish | 2012 | 7 | 24.29 | 5.26 | 130.24 | 11.63 | 3.72 | 6.98 | 152.57 | 85 |
| Mixed troll and bottomfish | 2013 | 21 | 16.67 | 5.17 | 86.09 | 16.18 | 6.24 | 5.69 | 114.19 | 75 |
| Mixed troll and bottomfish | 2014 | 17 | 18.18 | 5.12 | 93.45 | 12.58 | 9.12 | 21.73 | 136.88 | 68 |
| Mixed troll and bottomfish | 2015 | 15 | 23.93 | 4.11 | 97.98 | 12.60 | 10.55 | 38.76 | 159.89 | 61 |
| Mixed troll and bottomfish | 2016 | 17 | 22.91 | 3.51 | 79.64 | 20.09 | 15.26 | 48.84 | 163.82 | 49 |
| Mixed troll and bottomfish | 2017 | 12 | 14.92 | 3.79 | 56.22 | 16.36 | 17.75 | 16.67 | 107.00 | 53 |
| Bottomfish | 2011 | * | * | * | * | * | * | * | * | * |
| Bottomfish | 2012 | 5 | 7.00 | 5.01 | 35.70 | 12.26 | 8.25 | 19.54 | 75.75 | 47 |
| Bottomfish | 2013 | 8 | 7.13 | 5.17 | 36.80 | 6.97 | 12.69 | 9.50 | 65.96 | 56 |
| Bottomfish | 2014 | 26 | 5.19 | 5.09 | 26.13 | 7.42 | 11.00 | 10.11 | 54.64 | 48 |
| Bottomfish | 2015 | 12 | 4.25 | 4.24 | 18.00 | 6.64 | 11.05 | 7.79 | 43.48 | 41 |
| Bottomfish | 2016 | 7 | 4.46 | 3.49 | 15.50 | 6.42 | 6.30 | 8.49 | 36.71 | 42 |
| Bottomfish | 2017 | 13 | 9.62 | 3.65 | 35.41 | 12.03 | 18.23 | 6.54 | 72.21 | 49 |
| Spear/snorkel | 2011 | * | * | * | * | * | * | * | * | * |
| Spear/snorkel | 2012 | * | * | * | * | * | * | * | * | * |
| Spear/snorkel | 2013 | * | * | * | * | * | * | * | * | * |
| Spear/snorkel | 2014 | 4 | 3.75 | 5.22 | 19.43 | 11.17 | 0.00 | 0.00 | 30.60 | 63 |
| Spear/snorkel | 2015 | 6 | 6.83 | 4.17 | 28.53 | 7.24 | 0.00 | 0.00 | 35.78 | 80 |
| Spear/snorkel | 2016 | 4 | 6.00 | 3.57 | 21.58 | 7.30 | 0.00 | 0.00 | 28.88 | 75 |
| Spear/snorkel | 2017 | 7 | 7.21 | 3.65 | 25.79 | 11.59 | 0.00 | 7.14 | 44.52 | 58 |
| Gillnet | 2011 | 0 | - | - | - | - | - | - | - | - |
| Gillnet | 2012 | 3 | 1.17 | 4.71 | 5.87 | 17.37 | 0.00 | 0.00 | 23.24 | 25 |
| Gillnet | 2013 | 9 | 3.28 | 5.16 | 16.66 | 8.35 | 0.00 | 0.00 | 25.00 | 67 |
| Gillnet | 2014 | 5 | 4.40 | 5.12 | 22.52 | 10.49 | 0.00 | 0.00 | 33.01 | 68 |
| Gillnet | 2015 | 3 | 1.33 | 4.07 | 5.36 | 3.55 | 0.00 | 0.00 | 8.91 | 60 |
| Gillnet | 2016 | * | * | * | * | * | * | * | * | * |
| Gillnet | 2017 | 0 | - | - | - | - | - | - | - | - |
| Mixed troll & spear/snorkel | 2011 | * | * | * | * | * | * | * | * | * |
| Mixed troll & spear/snorkel | 2012 | * | * | * | * | * | * | * | * | * |
| Mixed troll & spear/snorkel | 2013 | 3 | 6.67 | 5.19 | 34.52 | 7.87 | 0.00 | 0.00 | 42.39 | 81 |
| Mixed troll & spear/snorkel | 2014 | * | * | * | * | * | * | * | * | * |
| Mixed troll & spear/snorkel | 2015 | * | * | * | * | * | * | * | * | * |
| Mixed troll & spear/snorkel | 2016 | * | * | * | * | * | * | * | * | * |
| Mixed troll & spear/snorkel | 2017 | 5 | 14.80 | 3.83 | 56.68 | 13.80 | 0.00 | 4.40 | 74.88 | 76 |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

**Table D 7. Fishing trip costs and fuel cost share by sub-fishery and year (mean, standard error, and median), Guam small boat fishery (adjusted to 2017 dollars)**

| Sub-fishery | Year | *Number of interviews (n)* | Mean | Standard error | Median |
|---|---|---|---|---|---|
| Pelagic | 2011 | 79 | 107.96 | 8.49 | 94.53 |
| Pelagic | 2012 | 52 | 126.10 | 15.67 | 93.38 |
| Pelagic | 2013 | 225 | 100.97 | 4.70 | 85.15 |
| Pelagic | 2014 | 126 | 108.81 | 6.53 | 92.25 |
| Pelagic | 2015 | 180 | 99.24 | 4.77 | 84.27 |
| Pelagic | 2016 | 100 | 78.13 | 7.06 | 63.45 |
| Pelagic | 2017 | 132 | 98.23 | 5.96 | 82.85 |
| Bottomfish | 2011 | * | * | * | * |
| Bottomfish | 2012 | 5 | 75.75 | 31.69 | 44.12 |
| Bottomfish | 2013 | 8 | 65.96 | 20.95 | 43.22 |
| Bottomfish | 2014 | 26 | 54.64 | 9.54 | 39.45 |
| Bottomfish | 2015 | 12 | 43.48 | 8.19 | 31.37 |
| Bottomfish | 2016 | 7 | 36.71 | 6.21 | 44.90 |
| Bottomfish | 2017 | 13 | 72.21 | 8.78 | 82.95 |
| Coral reef | 2011 | 7 | 21.29 | 8.28 | 17.77 |
| Coral reef | 2012 | 4 | 23.69 | 8.00 | 20.64 |
| Coral reef | 2013 | 17 | 28.67 | 5.71 | 16.65 |
| Coral reef | 2014 | 16 | 37.31 | 8.94 | 19.83 |
| Coral reef | 2015 | 18 | 54.14 | 20.11 | 31.41 |
| Coral reef | 2016 | 11 | 35.68 | 7.86 | 34.13 |
| Coral reef | 2017 | 14 | 48.55 | 9.73 | 28.20 |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

**Table D 8. Fishing trip costs and fuel cost share by category, sub-fishery, and year, Guam small boat fishery (adjusted to 2017 dollars)**

| Sub-fishery | Year | *Number of interviews (n)* | Fuel use (gallons) | Fuel price ($/gallon) | Fuel ($) | Ice ($) | Bait & chum ($) | Gear lost ($) | Total trip cost ($) | Fuel cost share (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Pelagic | 2011 | 79 | 15.79 | 5.13 | 80.90 | 11.58 | 4.59 | 10.89 | 107.96 | 75 |
| Pelagic | 2012 | 52 | 15.58 | 5.21 | 82.21 | 12.34 | 5.15 | 26.41 | 126.10 | 65 |
| Pelagic | 2013 | 225 | 13.35 | 5.18 | 68.85 | 12.58 | 0.95 | 18.60 | 100.97 | 68 |
| Pelagic | 2014 | 126 | 13.73 | 5.03 | 68.88 | 11.87 | 4.04 | 24.02 | 108.81 | 63 |
| Pelagic | 2015 | 180 | 12.57 | 4.15 | 52.37 | 11.93 | 7.60 | 27.33 | 99.24 | 53 |
| Pelagic | 2016 | 100 | 12.06 | 3.65 | 43.20 | 10.67 | 3.87 | 20.39 | 78.13 | 55 |
| Pelagic | 2017 | 132 | 12.05 | 3.82 | 45.92 | 19.81 | 9.26 | 23.25 | 98.23 | 47 |
| Bottomfish | 2011 | * | * | * | * | * | * | * | * | * |
| Bottomfish | 2012 | 5 | 7.00 | 5.01 | 35.70 | 12.26 | 8.25 | 19.54 | 75.75 | 47 |
| Bottomfish | 2013 | 8 | 7.13 | 5.17 | 36.80 | 6.97 | 12.69 | 9.50 | 65.96 | 56 |
| Bottomfish | 2014 | 26 | 5.19 | 5.09 | 26.13 | 7.42 | 11.00 | 10.11 | 54.64 | 48 |
| Bottomfish | 2015 | 12 | 4.25 | 4.24 | 18.00 | 6.64 | 11.05 | 7.79 | 43.48 | 41 |
| Bottomfish | 2016 | 7 | 4.46 | 3.49 | 15.50 | 6.42 | 6.30 | 8.49 | 36.71 | 42 |
| Bottomfish | 2017 | 13 | 9.62 | 3.65 | 35.41 | 12.03 | 18.23 | 6.54 | 72.21 | 49 |
| Coral reef | 2011 | 7 | 3.26 | 5.07 | 16.77 | 4.52 | 0.00 | 0.00 | 21.29 | 79 |
| Coral reef | 2012 | 4 | 1.88 | 4.88 | 9.80 | 13.90 | 0.00 | 0.00 | 23.69 | 41 |
| Coral reef | 2013 | 17 | 3.82 | 5.15 | 19.58 | 8.23 | 0.22 | 0.64 | 28.67 | 68 |
| Coral reef | 2014 | 16 | 5.19 | 5.01 | 26.40 | 9.57 | 1.35 | 0.00 | 37.31 | 71 |
| Coral reef | 2015 | 18 | 6.39 | 4.29 | 27.20 | 5.20 | 3.32 | 18.41 | 54.14 | 50 |
| Coral reef | 2016 | 11 | 6.55 | 3.62 | 23.82 | 8.14 | 0.00 | 3.73 | 35.68 | 67 |
| Coral reef | 2017 | 14 | 8.25 | 3.74 | 30.68 | 10.59 | 2.14 | 5.14 | 48.55 | 63 |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

**Table D 9. Fishing trip costs by gear and year (mean, standard error, and median), CNMI small boat fishery (adjusted to 2017 dollars)**

| Gear | Year | *Number of interviews (n)* | Mean | Standard error | Median |
|---|---|---|---|---|---|
| Troll | 2009 | 40 | 77.40 | 3.83 | 73.68 |
| Troll | 2010 | 67 | 72.79 | 3.19 | 71.80 |
| Troll | 2011 | 68 | 79.22 | 3.87 | 78.38 |
| Troll | 2012 | 109 | 88.13 | 4.23 | 80.35 |
| Troll | 2013 | 119 | 96.21 | 3.89 | 90.57 |
| Troll | 2014 | 136 | 91.75 | 3.55 | 87.19 |
| Troll | 2015 | 80 | 80.19 | 3.50 | 77.62 |
| Troll | 2016 | 60 | 69.35 | 3.13 | 68.40 |
| Troll | 2017 | 54 | 76.04 | 4.90 | 73.49 |
| Bottomfish | 2009 | 15 | 38.91 | 12.58 | 14.07 |
| Bottomfish | 2010 | 17 | 19.56 | 4.53 | 12.59 |
| Bottomfish | 2011 | 20 | 18.61 | 4.82 | 9.21 |
| Bottomfish | 2012 | 23 | 59.25 | 15.43 | 20.85 |
| Bottomfish | 2013 | 17 | 61.97 | 21.08 | 19.77 |
| Bottomfish | 2014 | 16 | 21.97 | 3.97 | 21.82 |
| Bottomfish | 2015 | 11 | 35.83 | 8.78 | 27.26 |
| Bottomfish | 2016 | 13 | 64.58 | 14.57 | 62.70 |
| Bottomfish | 2017 | 7 | 38.12 | 13.87 | 41.82 |
| Spear/snorkel | 2009 | 10 | 14.54 | 6.74 | 7.81 |
| Spear/snorkel | 2010 | * | * | * | * |
| Spear/snorkel | 2011 | 5 | 8.88 | 2.49 | 7.07 |
| Spear/snorkel | 2012 | 6 | 9.49 | 2.03 | 9.69 |
| Spear/snorkel | 2013 | 3 | 7.47 | 1.74 | 6.04 |
| Spear/snorkel | 2014 | * | * | * | * |
| Spear/snorkel | 2015 | * | * | * | * |
| Spear/snorkel | 2016 | 0 | - | - | - |
| Spear/snorkel | 2017 | 0 | - | - | - |
| Mixed troll and bottomfish | 2009 | * | * | * | * |
| Mixed troll and bottomfish | 2010 | * | * | * | * |
| Mixed troll and bottomfish | 2011 | 7 | 82.98 | 13.70 | 59.53 |
| Mixed troll and bottomfish | 2012 | 3 | 82.81 | 29.18 | 104.24 |
| Mixed troll and bottomfish | 2013 | 6 | 82.77 | 19.06 | 63.77 |
| Mixed troll and bottomfish | 2014 | * | * | * | * |
| Mixed troll and bottomfish | 2015 | * | * | * | * |
| Mixed troll and bottomfish | 2016 | * | * | * | * |
| Mixed troll and bottomfish | 2017 | 0 | - | - | - |
| Atulai | 2009 | 5 | 21.85 | 4.55 | 17.23 |
| Atulai | 2010 | 0 | - | - | - |
| Atulai | 2011 | * | * | * | * |
| Atulai | 2012 | * | * | * | * |
| Atulai | 2013 | 3 | 4.42 | 0.98 | 3.44 |
| Atulai | 2014 | 0 | - | - | - |
| Atulai | 2015 | * | * | * | * |
| Atulai | 2016 | 0 | - | - | - |
| Atulai | 2017 | 0 | - | - | - |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

**Table D 10. Fishing trip costs and fuel cost share by category, gear, and year, CNMI small boat fishery (adjusted to 2017 dollars)**

| Gear | Year | *Number of interviews (n)* | Fuel use (gallons) | Fuel price ($/gallon) | Fuel ($) | Ice ($) | Bait & chum ($) | Gear lost ($) | Total trip cost ($) | Fuel cost share (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Troll | 2009 | 40 | 19.11 | 3.52 | 67.69 | 8.89 | 0.00 | 0.82 | 77.40 | 87 |
| Troll | 2010 | 67 | 16.81 | 3.84 | 64.53 | 8.26 | 0.00 | 0.00 | 72.79 | 89 |
| Troll | 2011 | 68 | 15.82 | 4.50 | 71.60 | 6.47 | 0.00 | 1.15 | 79.22 | 90 |
| Troll | 2012 | 109 | 16.23 | 4.84 | 78.55 | 7.35 | 0.00 | 2.23 | 88.13 | 89 |
| Troll | 2013 | 119 | 18.04 | 4.94 | 88.86 | 7.27 | 0.07 | 0.00 | 96.21 | 92 |
| Troll | 2014 | 136 | 17.01 | 4.84 | 82.48 | 9.22 | 0.05 | 0.00 | 91.75 | 90 |
| Troll | 2015 | 80 | 17.19 | 4.14 | 70.75 | 9.43 | 0.00 | 0.00 | 80.19 | 88 |
| Troll | 2016 | 60 | 17.02 | 3.57 | 60.46 | 8.90 | 0.00 | 0.00 | 69.35 | 87 |
| Troll | 2017 | 54 | 17.17 | 3.94 | 67.73 | 8.13 | 0.00 | 0.19 | 76.04 | 89 |
| Bottomfish | 2009 | 15 | 9.03 | 3.47 | 31.85 | 4.04 | 2.88 | 0.14 | 38.91 | 82 |
| Bottomfish | 2010 | 17 | 4.47 | 3.84 | 17.27 | 2.29 | 0.00 | 0.00 | 19.56 | 88 |
| Bottomfish | 2011 | 20 | 3.54 | 4.57 | 16.03 | 1.50 | 0.98 | 0.10 | 18.61 | 86 |
| Bottomfish | 2012 | 23 | 10.30 | 4.74 | 49.35 | 7.53 | 2.37 | 0.00 | 59.25 | 83 |
| Bottomfish | 2013 | 17 | 11.34 | 4.96 | 56.23 | 3.41 | 1.75 | 0.58 | 61.97 | 91 |
| Bottomfish | 2014 | 16 | 4.06 | 4.83 | 19.43 | 2.54 | 0.00 | 0.00 | 21.97 | 88 |
| Bottomfish | 2015 | 11 | 7.82 | 4.16 | 32.63 | 3.20 | 0.00 | 0.00 | 35.83 | 91 |
| Bottomfish | 2016 | 13 | 16.04 | 3.59 | 57.08 | 7.50 | 0.00 | 0.00 | 64.58 | 88 |
| Bottomfish | 2017 | 7 | 8.36 | 3.87 | 32.05 | 5.36 | 0.71 | 0.00 | 38.12 | 84 |
| Spear/snorkel | 2009 | 10 | 3.48 | 3.46 | 12.22 | 2.32 | 0.00 | 0.00 | 14.54 | 84 |
| Spear/snorkel | 2010 | * | * | * | * | * | * | * | * | * |
| Spear/snorkel | 2011 | 5 | 1.50 | 4.66 | 6.98 | 1.90 | 0.00 | 0.00 | 8.88 | 79 |
| Spear/snorkel | 2012 | 6 | 1.67 | 4.80 | 8.09 | 1.41 | 0.00 | 0.00 | 9.49 | 85 |
| Spear/snorkel | 2013 | 3 | 1.33 | 4.78 | 6.40 | 1.07 | 0.00 | 0.00 | 7.47 | 86 |
| Spear/snorkel | 2014 | * | * | * | * | * | * | * | * | * |
| Spear/snorkel | 2015 | * | * | * | * | * | * | * | * | * |
| Spear/snorkel | 2016 | 0 | - | - | - | - | - | - | - | - |
| Spear/snorkel | 2017 | 0 | - | - | - | - | - | - | - | - |
| Mixed troll and bottomfish | 2009 | * | * | * | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2010 | * | * | * | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2011 | 7 | 16.86 | 4.64 | 78.14 | 4.84 | 0.00 | 0.00 | 82.98 | 94 |
| Mixed troll and bottomfish | 2012 | 3 | 15.00 | 4.82 | 73.64 | 5.31 | 3.86 | 0.00 | 82.81 | 89 |
| Mixed troll and bottomfish | 2013 | 6 | 15.00 | 4.98 | 74.77 | 5.36 | 2.64 | 0.00 | 82.77 | 90 |
| Mixed troll and bottomfish | 2014 | * | * | * | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2015 | * | * | * | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2016 | * | * | * | * | * | * | * | * | * |
| Mixed troll and bottomfish | 2017 | 0 | - | - | - | - | - | - | - | - |
| Atulai | 2009 | 5 | 3.90 | 3.57 | 14.05 | 1.69 | 6.11 | 0.00 | 21.85 | 64 |
| Atulai | 2010 | 0 | - | - | - | - | - | - | - | - |
| Atulai | 2011 | * | * | * | * | * | * | * | * | * |
| Atulai | 2012 | * | * | * | * | * | * | * | * | * |
| Atulai | 2013 | 3 | 0.67 | 4.98 | 3.35 | 1.07 | 0.00 | 0.00 | 4.42 | 76 |
| Atulai | 2014 | 0 | - | - | - | - | - | - | - | - |
| Atulai | 2015 | * | * | * | * | * | * | * | * | * |
| Atulai | 2016 | 0 | - | - | - | - | - | - | - | - |
| Atulai | 2017 | 0 | - | - | - | - | - | - | - | - |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

**Table D 11. Fishing trip costs by sub-fishery and year (mean, standard error, and median), CNMI small boat fishery (adjusted to 2017 dollars)**

| Sub-fishery | Year | *Number of interviews (n)* | Mean | Standard error | Median |
|---|---|---|---|---|---|
| Pelagic | 2009 | 40 | 77.40 | 3.83 | 73.68 |
| Pelagic | 2010 | 67 | 72.79 | 3.19 | 71.80 |
| Pelagic | 2011 | 67 | 80.24 | 3.79 | 78.46 |
| Pelagic | 2012 | 109 | 88.13 | 4.23 | 80.35 |
| Pelagic | 2013 | 119 | 96.21 | 3.89 | 90.57 |
| Pelagic | 2014 | 135 | 92.29 | 3.53 | 87.24 |
| Pelagic | 2015 | 80 | 80.19 | 3.50 | 77.62 |
| Pelagic | 2016 | 58 | 71.36 | 2.89 | 69.90 |
| Pelagic | 2017 | 53 | 77.38 | 4.81 | 73.95 |
| Bottomfish | 2009 | 15 | 38.91 | 12.58 | 14.07 |
| Bottomfish | 2010 | 17 | 19.56 | 4.53 | 12.59 |
| Bottomfish | 2011 | 20 | 18.61 | 4.82 | 9.21 |
| Bottomfish | 2012 | 23 | 59.25 | 15.43 | 20.85 |
| Bottomfish | 2013 | 17 | 61.97 | 21.08 | 19.77 |
| Bottomfish | 2014 | 16 | 21.97 | 3.97 | 21.82 |
| Bottomfish | 2015 | 11 | 35.83 | 8.78 | 27.26 |
| Bottomfish | 2016 | 13 | 64.58 | 14.57 | 62.70 |
| Bottomfish | 2017 | 7 | 38.12 | 13.87 | 41.82 |
| Coral reef | 2009 | 16 | 16.21 | 4.48 | 8.60 |
| Coral reef | 2010 | * | * | * | * |
| Coral reef | 2011 | 9 | 8.51 | 1.40 | 7.07 |
| Coral reef | 2012 | 8 | 8.02 | 1.77 | 7.71 |
| Coral reef | 2013 | 6 | 5.95 | 1.12 | 5.74 |
| Coral reef | 2014 | 4 | 10.72 | 2.93 | 8.85 |
| Coral reef | 2015 | * | * | * | * |
| Coral reef | 2016 | * | * | * | * |
| Coral reef | 2017 | * | * | * | * |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.

**Table D 12. Fishing trip costs and fuel cost share by category, sub-fishery, and year, CNMI small boat fishery (adjusted to 2017 dollars)**

| Sub-fishery | Year | *Number of interviews (n)* | Fuel use (gallons) | Fuel price ($/gallon) | Fuel ($) | Ice ($) | Bait & chum ($) | Gear lost ($) | Total trip cost ($) | Fuel cost share (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Pelagic | 2009 | 40 | 19.11 | 3.52 | 67.69 | 8.89 | 0.00 | 0.82 | 77.40 | 87 |
| Pelagic | 2010 | 67 | 16.81 | 3.84 | 64.53 | 8.26 | 0.00 | 0.00 | 72.79 | 89 |
| Pelagic | 2011 | 67 | 16.03 | 4.50 | 72.53 | 6.54 | 0.00 | 1.17 | 80.24 | 90 |
| Pelagic | 2012 | 109 | 16.23 | 4.84 | 78.55 | 7.35 | 0.00 | 2.23 | 88.13 | 89 |
| Pelagic | 2013 | 119 | 18.04 | 4.94 | 88.86 | 7.27 | 0.07 | 0.00 | 96.21 | 92 |
| Pelagic | 2014 | 135 | 17.10 | 4.85 | 82.97 | 9.27 | 0.05 | 0.00 | 92.29 | 90 |
| Pelagic | 2015 | 80 | 17.19 | 4.14 | 70.75 | 9.43 | 0.00 | 0.00 | 80.19 | 88 |
| Pelagic | 2016 | 58 | 17.51 | 3.57 | 62.20 | 9.16 | 0.00 | 0.00 | 71.36 | 87 |
| Pelagic | 2017 | 53 | 17.47 | 3.94 | 68.93 | 8.25 | 0.00 | 0.19 | 77.38 | 89 |
| Bottomfish | 2009 | 15 | 9.03 | 3.47 | 31.85 | 4.04 | 2.88 | 0.14 | 38.91 | 82 |
| Bottomfish | 2010 | 17 | 4.47 | 3.84 | 17.27 | 2.29 | 0.00 | 0.00 | 19.56 | 88 |
| Bottomfish | 2011 | 20 | 3.54 | 4.57 | 16.03 | 1.50 | 0.98 | 0.10 | 18.61 | 86 |
| Bottomfish | 2012 | 23 | 10.30 | 4.74 | 49.35 | 7.53 | 2.37 | 0.00 | 59.25 | 83 |
| Bottomfish | 2013 | 17 | 11.34 | 4.96 | 56.23 | 3.41 | 1.75 | 0.58 | 61.97 | 91 |
| Bottomfish | 2014 | 16 | 4.06 | 4.83 | 19.43 | 2.54 | 0.00 | 0.00 | 21.97 | 88 |
| Bottomfish | 2015 | 11 | 7.82 | 4.16 | 32.63 | 3.20 | 0.00 | 0.00 | 35.83 | 91 |
| Bottomfish | 2016 | 13 | 16.04 | 3.59 | 57.08 | 7.50 | 0.00 | 0.00 | 64.58 | 88 |
| Bottomfish | 2017 | 7 | 8.36 | 3.87 | 32.05 | 5.36 | 0.71 | 0.00 | 38.12 | 84 |
| Coral reef | 2009 | 16 | 3.45 | 3.49 | 12.25 | 2.06 | 1.91 | 0.00 | 16.21 | 76 |
| Coral reef | 2010 | * | * | * | * | * | * | * | * | * |
| Coral reef | 2011 | 9 | 1.50 | 4.65 | 6.97 | 1.55 | 0.00 | 0.00 | 8.51 | 82 |
| Coral reef | 2012 | 8 | 1.38 | 4.81 | 6.67 | 1.36 | 0.00 | 0.00 | 8.02 | 83 |
| Coral reef | 2013 | 6 | 1.00 | 4.88 | 4.87 | 1.07 | 0.00 | 0.00 | 5.95 | 82 |
| Coral reef | 2014 | 4 | 2.00 | 4.68 | 8.88 | 1.84 | 0.00 | 0.00 | 10.72 | 83 |
| Coral reef | 2015 | * | * | * | * | * | * | * | * | * |
| Coral reef | 2016 | * | * | * | * | * | * | * | * | * |
| Coral reef | 2017 | * | * | * | * | * | * | * | * | * |

* The number of boats (respondents) was fewer than three; due to confidentiality concerns, responses are not presented.