From: Michael Weiss - NOAA Federal
To: Bowman, Randal
Subject: Re: FWS Executive Summaries
Date: Tuesday, July 25, 2017 2:11:42 PM
Attachments: DOI Tuna Questions.docx
Papa" economic analysis (1) (1).pdf

Hi Randy. Attached are the responses to the questions re: Tuna fishery. Also attached is the Pacific Island Fishery Science Center Internal Report IR-17-06 that is referenced in the last response. Will send the NE information when I get it.

On Tue, Jul 25, 2017 at 12:25 PM, Bowman, Randal <randal_bowman@ios.doi.gov> wrote:

> yes, and there are some things we need to cover. As of right now, any time this afternoon after 2 or tomorrow is open.
>
> Also, I do not need information from NMFS on catch etc in the NE C&S monument, as we received a letter from NE Council that had that. Copy was also sent to Sec. Ross, dated June 29. It wasn't sent to our comment mail stop, so just showed up. I still need the information I requested for the Pacific.
>
> On Tue, Jul 25, 2017 at 12:16 PM, Michael Weiss - NOAA Federal <michael.weiss@noaa.gov> wrote:
>
> > Hi Randy.
> >
> > Thanks for the response.
> >
> > Do you have time today or tomorrow to catch up?
> >
> > Michael
> >
> > On Mon, Jul 24, 2017 at 1:43 PM, Bowman, Randal <randal_bowman@ios.doi.gov> wrote:
> >
> > > Not exactly. BLM prepared these for each of their monuments as part of the material submitted, and I expanded them to include other material we had asked for. Downey liked the results and asked that I get them for the other monuments (i.e. NPS and FWS). I included the marine so the information would be available. My request is below, with the sample summary. At the same, as I have indicated before, the Secretary has been impressed by arguments raised by fishermen in New England and the case presented on Pacific tuna fishery, on both of which I have asked you for information. Perhaps we should talk further on going forward.
> > >
> > > On Thu, Jul 6, 2017 at 5:51 PM, Bowman, Randal <randal_bowman@ios.doi.gov> wrote:
> > >
> > > > BLM has provided Executive Summaries for each of their monuments under review, which Downey found very helpful. Would you please provide the same for your monuments - a sample is attached.
> > > >
> > > > I have deleted from all of the BLM reports, including the sample, information which is addressed in the economic reports, to avoid duplication, so please don't include economic data in your summary.

Jeff, one for Hanford Reach, one covering the Pacific marine monuments and one for NE Canyons and Seamounts might be the easiest approach for you, but if you want to do more for the Pacific, feel free.

Could both agencies have them done within 2 weeks?

On Mon, Jul 24, 2017 at 12:43 PM, Michael Weiss - NOAA Federal <michael.weiss@noaa.gov> wrote:

Morning Randy. Hope you had a nice weekend.

Hoping you can provide some clarity here.

On Friday, our folks received from FWS regional staff "Executive Summaries" for reviews of each of the Pacific marine national monuments. These summaries were, I believe, prepared by FWS HQ. We were asked to provide comments by 9:00am this morning.

Trying to get some clarity as to what are these Executive Summaries. Is DOI developing its own report on the marine national monuments?

Thanks,

Michael

--
Michael Weiss
Office of the Under Secretary
National Oceanic and Atmospheric Administration
202-482-5958 (w)
(b) (6) (c)

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For the Pacific, I'd appreciate a little more information given our role with the territories –

1) how many American (and foreign, if applicable) tuna boats (long-line and purse seine) were based in American Samoa, Guam and CNMI in 2000, 2005, 2010, 2015 and now - or whatever other set of years NMFS has information most readily available on; I want to be able to show evolution over time, but am not hung up over which years to use for that comparison. Also not sure there are any tuna boats based in Guam and CNMI.

In the mid-1990s, American Samoa fishermen began to experience success using pelagic longline fishing gear on a small locally built, inexpensive aluminum catamaran called an "alia." In 1997, the first large mono-hulled longline vessel capable of making multi-day trips began operating out of American Samoa. One year later, there were 25 alia and large longline vessels active in the fishery. The alia fleet dwindled and the large vessel numbers increased still further and currently there are 40 large longline fishing permits and 5 alia permits (but only one active alia).

There are currently 35 US flagged purse seiners operating in the Central and Western Pacific Ocean. Historically, most of the US purse seine catch was off-loaded to the two canneries in Pago Pago. However, some operators have opted to land or transship their catch in the Federated States of Micronesia, Marshall Islands, Papua New Guinea and the Solomon Islands. Some is sourcing canneries in those nations and the rest is sent to canneries in Thailand and Latin America.

There are a large number of individual foreign longline and purse seine vessels, making a large and variable annual number of port calls in Pago Pago to land (for the canneries) and transship fish.

In the early 1980s, US purse-seine vessels established a transshipment operation at Tinian Harbor. Purse seine vessel operators took advantage of fishing grounds in the Western Pacific and offloaded their catch at Tinian for transshipment to the canneries in America Samoa; however, this operation ceased in the 1990s. A small longline fishery started operating in the CNMI in the early 2000s but ceased in 2012. CNMI tends to have fewer than 50 vessels engaged in commercial pelagic fishing. Most vessels are outfitted with rod and reel gear and lack the capacity for longline gear or to chill large amounts of catch.

In the late 1980s, Guam was an important transshipment port for Japanese and Taiwanese longline fleets. Landed fish was packed and transshipped by air to Japan. By the early 2000s, air transshipment operations were established in the Federated States of Micronesia and port calls and transshipment volume on Guam have steadily declined. Today, the Guam commercial fleet is predominantly a troll fishery and a small charter fishery. Around 200 small commercial vessels are engaged in some aspect of commercial pelagic fishing. Most vessels are outfitted with rod and reel gear and lack the capacity for longline gear or to chill large amounts of catch.

2) for whatever American and foreign boats are based in any of the 3 territories, what percent of their tuna catch was previous to the initial Proclamation taken in the PRI monument, and in the Expansion area, by year of possible.

The Hawaii Longline fishery is managed under a limited access program with no more than 164 permits. Roughly 4% of the longline fishing effort took place in the EEZ of the Pacific Remote Island Areas (PRIA) prior to designation and expansion. Between 1991 and 2007, Hawaii longline vessels caught on average about 1.24 million pounds of fish from the U.S. EEZ, with about 60% coming from the U.S. EEZ around Kingman and Palmyra and most of the remainder from the U.S. EEZ around Johnston. While it is difficult to estimate the direct and indirect impacts (economic – negatives and biological – positives) of these closures, it is reasonable to foresee that there would be a decrease in revenue overall given the reduced fishing area alone, the loss in likely greater since the PRIA EEZs specifically represent an important yellowfin tuna fishing grounds. The overall catch composition of these two tuna species (bigeye:yellowfin) is 10:1. However, the catch from the PRIA EEZs is roughly 2:1 and represents a significant portion of the valuable yellowfin landings. At certain times of the year and for certain social and cultural purposes, yellowfin tuna is especially important. Eliminating this yellowfin fishing area could result in a revenue loss in part because the displaced effort would target less valuable bigeye tuna. The displaced effort could also increase the fishing pressure on bigeye tuna (the only stock determined to be experiencing overfishing). There is also a likelihood that the effort would shift to an area closer to the Hawaiian Islands (both zones are at the southern extent of the fishery and the fishery would likely contract not expand past these zones) and it would be problematic if effort moved to the southern Hawaii EEZ, where interactions with false killer whales are historically highest. The closure would reduce the availability of yellowfin tuna when it is seasonally important in a cultural context. Since the demand for yellowfin tuna would likely remain, imports of foreign-caught yellowfin tuna may increase. It has been documented that the transferred effects of reducing the more responsibly managed U.S. fisheries is detrimental to many other species including sea turtles and marine mammals.

The US purse seine fishery is limited to 40 vessels that operate principally under a multilateral treaty which allows them access to fish for tunas in the waters of 16 Pacific Island countries and the preferred fishing grounds are in foreign zones of the equatorial Western Pacific. However when El Niño – Southern Oscillation (ENSO) patterns affect the distribution of warm surface waters, skipjack and yellowfin tuna become more abundant in the Central Pacific and the U.S. EEZs become important, particularly around Howland and Baker Islands. This catch has been highly variable between 1997 and 2007, with 25% of their total catch coming from the PRIA in 1997, mainly from the U.S. EEZ around Howland and Baker Islands, when about 35,000 metric tons of fish was taken within the EEZ to some years with a nominal amount taken. The closure of the PRIA EEZs would include extended impacts to the Territory of American Samoa through a disruption of a tuna source to the canneries. Losing access to the only area under solely U. S. control is especially impacting to the U.S.-built vessels in the fleet (currently 9 of 35 in the fleet) have unique access to the EEZ (as only US-built vessels can obtain fisheries endorsement and fish in the EEZ) and predominately operate out of American Samoa and source tuna for the cannery there.

3) How the tuna treaty works with respect to allocations, and what % of each territory's allocation do boats based there use each year - again, going back to 2000 or when the treaty went into effect.

This question incorrectly links the tuna treaty (presumed to mean the South Pacific Tuna Treaty and the US purse seine fishery that operates under it) to territory allocations (currently only in place for longline fisheries - bigeye catch limit).

For the Tuna Treaty (how it works) – see http://www.fpir.noaa.gov/IFD/ifd_sptt.html

For Territory allocations – see http://www.fpir.noaa.gov/SFD/pdfs/catch_fishing_effort_limits_WCPFC_compliance_guide.pdf

4) any information NMFS has about the American Samoa tuna canneries - why they were established there, roles of shortage of fish vs minimum wage being applied to Am Samoa in closures, any possible role of the treaty in cannery closures.

This question is very broad and outside of NMFS scope to answer. Why the canneries were established in Pago Pago is a question for those businesses making that decision. The sourcing of fish and minimum wage are two possible factors for closure, but are not necessarily closely linked and certainly not competing (versus?) factors. Their role and importance to decisions made need to be answered by those businesses involved. The status of the treaty is certainly is one of many factors that affect sourcing of tuna for the canneries, but again NMFS would only be able to speculate as to the role and importance to any business.

It is my understanding on the above, backed by NO hard information, that there have not been American tuna boats based in Am. Samoa until the recent purchase of 3 purse seine boats by Samoans, and that previous to that only foreign boats landed tuna there. I'm well aware that some or all of this could be wrong. I have no knowledge of any commercial tuna fishing in Guam or CNMI, except possibly by locals for local consumption.

See answers above.

I am presuming Sen. Schatz' letter of June 6 accurately describes the situation for the Hawaii-based tuna boats, in that notwithstanding the expansion of PMNM they catch their tuna quota well before the end of the year and need to purchase unused quota amounts from the territories to keep fishing; and anything NMFS has to add or expand upon that information would also be very useful.

Sen. Schatz' letter does not accurately describe the situation – see PIFSC Internal Report IR-17-06 issued 08 March 2017.

Potential Economic Impacts of the Papahānaumokuākea Marine National Monument Expansion[1]

PIFSC Socioeconomics Program

As presented at:
124th Scientific and Statistical Committee Meeting
168th Western Pacific Regional Fishery Management Council Meeting

This document is prepared in response to a request from Council to provide a formal report on a presentation provided at the 124th SSC and 168th Council Meetings relating to the potential economic impact of the expansion of the Papahānaumokuākea Marine National Monument

1. Introduction[2]

On August 26, 2016, President Obama issued a proclamation expanding the Papahānaumokuākea Marine National Monument (Monument) pursuant to the unilateral authority provided to the President of the United States under Antiquities Act of 1906. The proclamation expanded the monument from 139,797 square miles (362,073 km^2) to 582,578 square miles (1,508,870 km^2). The proclamation instructs the Secretary of Commerce, in coordination with the Secretary of the Interior, to prohibit, amongst other things, commercial fishing. However, the proclamation also provides that the Secretaries may permit certain activities such as non-commercial fishing including native Hawaiian subsistence fishing.

The respective statutory authority with respect to promulgating fisheries regulations for the expanded monument is the Magnuson Stevens Fisheries Conservation and Management Act (MSA). NOAA Fisheries has asked the Western Pacific Regional Fishery Management Council (Council) for recommendations on amending the Hawaii and Pelagic Fishery Ecosystem Plans to establish appropriate fishing requirements under the MSA, including the prohibition on commercial fishing and the regulation of non-commercial fishing in the expansion area of the PMNM.

This report follows the analysis presented at the 124th SSC and 168th Council meetings related to the potential economic impact of the expansion of the Papahānaumokuākea Marine National Monument. Section 2 outlines methods related to the calculation of economic impacts. Trends in recent catch and effort in Northwestern Hawaiian Islands (NWHI) waters along with economic impact estimates are provided in section 3. Lastly, section 4 identifies caveats associated with this analysis and suggests alternative methodologies that could be employed for a more robust assessment of the economic impacts of the Monument expansion.

[1] PIFSC Internal Report IR-17-06
Issued 08 March 2017.
[2] The first two paragraphs of the Introduction were provided in briefing documents by Council Staff .

DOI-2021-08 00619

Data

The PIFSC International Fisheries Program of the Fisheries Research and Monitoring Division (FRMD) provided recent historical data summaries based on Hawaii-permitted Longline logbook data coupled with State of Hawaii dealer data[3]. A number of scenarios were developed during 2016 to inform the Monument design process. It should be noted that data summaries generated and used for this analysis is based on an earlier draft of expanded Monument boundaries, defined as west of 161W (Figure 1). The final Monument designation was ultimately refined down to only include waters west of 163 W (Figure 2).

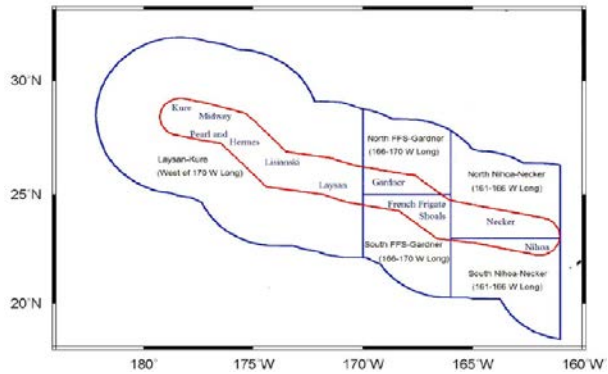

Figure 1.
Monument designation as basis for data used for this analysis (west of 161W)

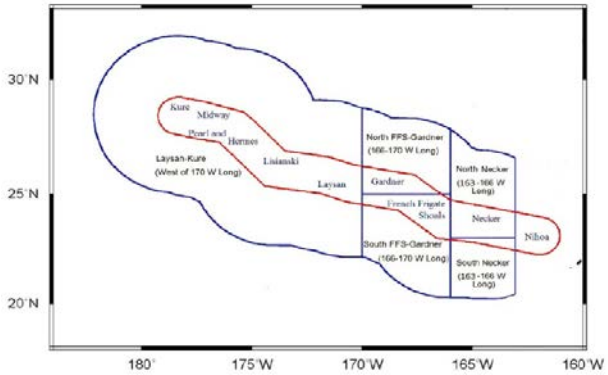

Figure 2.
Final Monument designation (west of 163W)

To control for this discrepancy between the scales for which the data are gathered in this analysis and the final Monument designation, we applied a simple correction factor to account for this difference. The PIFSC International Fisheries Program of the Fisheries Research and Monitoring Division (FRMD) estimated that between 2010 and 2015, an annual average of approximately 9.2% of total longline pounds (all species combined) were caught in the entire NWHI exclusive economic zone (EEZ) west of the 161 W meridian. Similarly, an annual average of approximately 6.5% of total longline pounds, were caught in the entire NWHI EEZ west of 163 W meridian (Table 1). Therefore, the correction factor used in this analysis is simply the difference between these values (-2.7%), which is used to deflate the numbers to align with the final monument designation boundary.

2. Methods

To arrive at the potential economic impact of the Monument expansion, this analysis assumes full loss of fishery revenues from waters where fishing is no longer permitted. It should be noted that this is an extreme approach that arrives at a maximum upper-bound of potential direct economic impact (in terms of lost revenues), as the Monument expansion did not preclude fishing outside the Monument waters. All revenue data were corrected for inflation using the

[3] Hawaii Longline Logbook: https://inport nmfs.noaa.gov/inport/item/2721
Hawaii Dealer Data: https://inport.nmfs noaa.gov/inport/item/5610

DOI-2021-08 00620

Honolulu consumer price index, all items, for all urban consumers (CPI-U), using a base of 1982-1984[4]. This ensures that all dollar values are directly comparable across years, and ensures a real dollar estimate for potential economic losses. In considering potential indirect revenue losses to fishery support industries, we relied on economic multipliers as defined in Arita et al., (2011). These multipliers relate changes in fishery production (in terms of revenues) to changes in indirect value to backward linkage sectors, such as fuel and gear supplies, dry dock services, and other support industries (Arita et al., 2011; Arita et al., 2013).

3. Results

This section will frame the potential economic impact of the Monument expansion in terms of recent catch and effort trends in the NWHI, potential direct fishery revenues lost, and potential indirect economic impacts. While there has been a general decline over the past 6 years in the share of fishing effort (in terms of total hooks set), total pelagic catch, and fishing revenues from the NWHI has supported a relatively small, yet consistent share of fishery catch and revenues, providing significant seafood contributions to Hawaii markets.

Catch Trends

The average annual pounds caught in the NWHI (west of 163W meridian) between 2010 and 2015 was approximately 2.48 million pounds per year, or approximately 6.5% of total longline catch. (Table 1, Table 2). The deep-set fishery accounted for roughly 87% of total NWHI pelagic pounds caught. However, a nominally larger share of shallow set fishery total catch has come from the NWHI relative to the deep-set fishery. The 2010-2015 average share of pelagic catch in the NWHI for the shallow set fishery is about 11% relative to about 9% for the deep-set fishery (Figure 3 and Table 3).

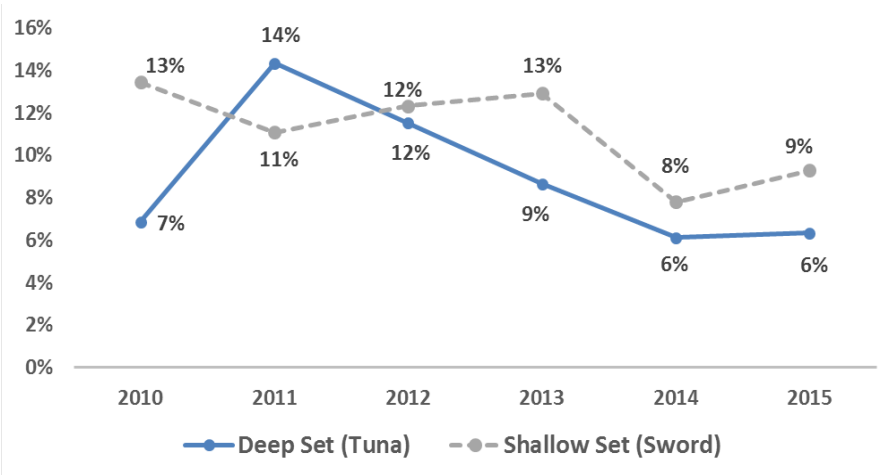

Figure 3. NWHI pelagic pounds caught as a share of total pelagic pounds caught, by fishery (2010-2015)

[4] https://www.bls.gov/regions/west/data/consumerpriceindex_honolulu_table.pdf

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Effort Trends

Effort in the Hawaii-permitted longline fishery is measured by number of hooks set. Effort trends in the NWHI between 2010 and 2015 closely mirror those of catch trends shown in Figure 3. The share of total hooks set in the NWHI for the shallow set fishery between 2010 and 2015 was approximately 12% relative to about 9% for deep-set fishing (Table 4). On average, between 2010 and 2015 there were about 4 million hooks set in the NWHI (Table 5).

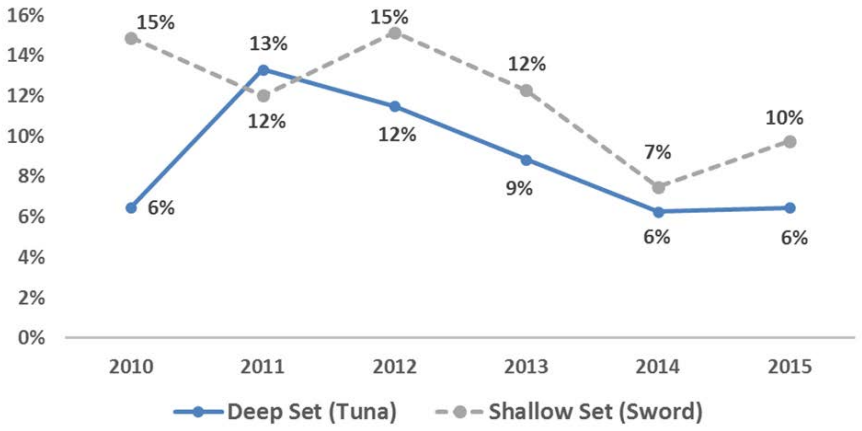

Figure 4. NWHI hooks set caught as a share of total hooks set, by fishery (2010-2015)

Catch Composition

Species composition of catch in the NWHI is another factor worth considering in the context of potential economic impacts from the Monument expansion. Between 2010 and 2015 the composition of catch in the NWHI varied slightly from non-NWHI catch. On average, there was a nominally smaller share of bigeye tuna (the highest value target species in the longline fishery) and moonfish (opah) in the NWHI, and nominally larger shares of yellowfin tuna, albacore tuna, swordfish, and striped marlin (Table 6).

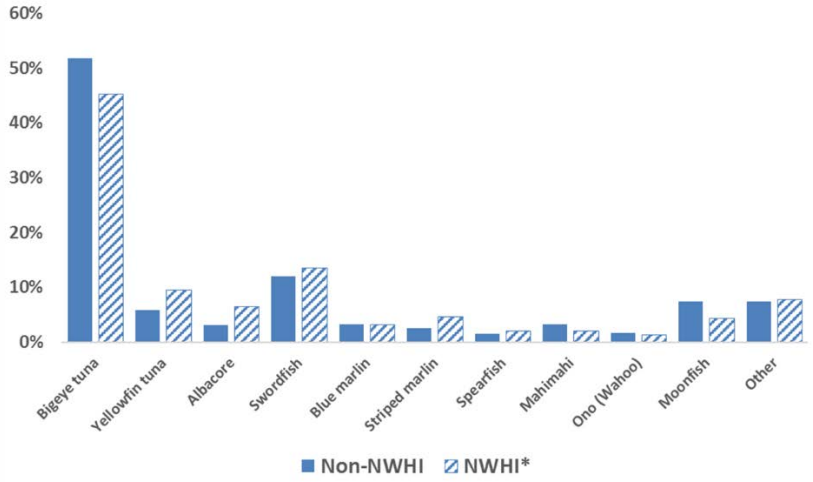

Figure 5. NWHI species composition of catch relative to non-NWHI catch composition, by weight (2010-2015)

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Direct Fishing Revenues

The average inflation-adjusted annual fishery revenues in the NWHI between 2010 and 2015 averaged approximately $7.8 million per year (Table 7). The shallow-set fishery has a nominally higher share of total revenues from the NWHI relative to the deep-set fishery. Between 2010 and 2015, the NWHI accounted for 10% of annual shallow set fishery revenues and approximately 8% for the deep-set fishery (Table 8). In considering the potential direct revenue impacts of the Monument Expansion, this $7.8 million per year should be considered an upper bound estimate. To realize this level of economic impact would require no spatial reallocation of effort to make up for this "lost" catch.

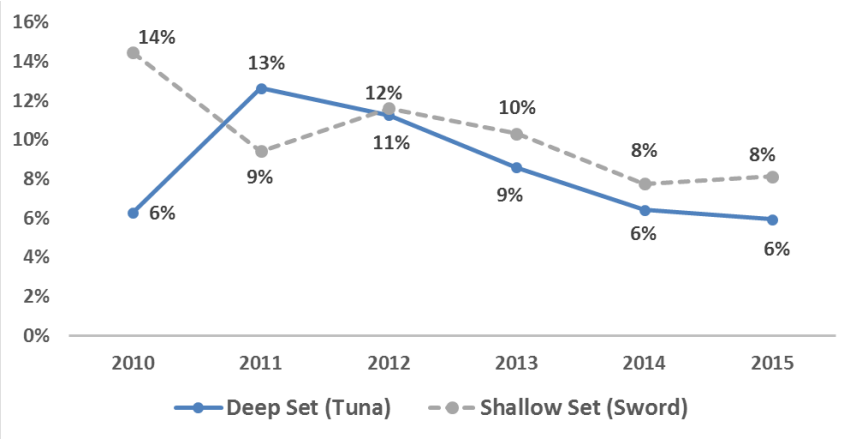


Figure 6. NWHI fishing revenues as a share of total fishing revenues, by fishery (2010-2015)

Indirect Revenues

In addition to potential direct revenue impacts to the fishery we can consider potential indirect effects of backward linkage scenarios. Using economic impact multipliers published in 2011 (Arita et al., 2011), one can estimate the potential economic impacts to related industry sectors such as fuel/gear suppliers, dry dock services, and other support industries. Using 2015 revenue estimates, we find potential indirect economic losses of approximately $9.1 million to linked sectors, $4.3 million in household income, approximately 75 jobs lost, and lost tax revenues of $561 thousand (Figure 7 and Table 9). Again, this assumes all catch is "lost" and not made up elsewhere, which may be an overly restrictive assumption.

Direct Value	Entire industry	NWHI	Units
Hawaii longline revenue in 2015	104	6.335	Millions
Indirect Value (Backward linkage sectors, such as fuel & gear supplies, dry dock services, etc.)			
1. Total Impact on Industries	149	9.059	Millions
2. Household Income	70	4.251	Millions
3. Job	1244	75	Jobs
4. Tax Revenue	9	0.561	Millions

Figure 7. Potential indirect revenue lost from Monument Expansion

DOI-2021-08 00623

4. Discussion

This report provides an overview of presentations given at the 124th Scientific and Statistical Committee and 168th Council Meeting. All potential economic impact estimates presented herein should be considered upper bound estimates as the Monument expansion did not directly restrict current fishing activity, but did modify the spatial extent to which the fishery could operate. The potential direct and indirect revenue loss estimates provided in section 3 are provided under the assumption that catch from the NWHI is completely "lost", which is likely an overly restrictive assumption.

It is difficult to quantify the true direct or indirect effects of the Monument expansion as many effects will take time to materialize. It is worth noting that fishermen will no longer have access to these traditional domestic fishing grounds within the United States EEZ, which may incur additional costs on the fleet as they reallocate their future effort elsewhere. The quick nature of this analysis does not allow us to understand the extent to which the cost of operations could change in response to a redistribution of traditional longline fishing effort away from the NWHI. The Pacific Islands Fisheries Science Center (PIFSC) Socioeconomics Program outlined multiple existing economic monitoring programs: (a) longline economic data collection program and (b) economic performance metrics that will provide insights to assess future changes in fishing costs and economic performance metrics as related to the Monument expansion.

In addition to economic impacts, it should be noted that there are potential sociocultural impacts of the Monument expansion that may warrant future research. While this report presented a fishery-level analysis, there is the potential for differential impacts among subgroups in the fishery (target species, vessel size, and/or ethnicity). As noted in section 3, the shallow-set fishery appears to have a nominally higher share of catch, effort, and revenues from the NWHI relative to the deep-set fishery. In addition to the potential for increased costs associated with fishing outside the EEZ there could be effects on the overall quality of the domestic product which could affect domestic market share and longer trips could impact both seafood safety and safety at sea for domestic fishing vessels.

References

Arita S, Pan M, Hospital J, Leung P.
2011. Contribution, linkages and impacts of the fisheries sector to Hawaii's economy: a social accounting matrix analysis. Joint Institute for Marine and Atmospheric Research, SOEST Publication 11-01, JIMAR Contribution 11-373. University of Hawaii: Honolulu, HI, 54 p.

Arita S, Pan M, Hospital J, Leung P.
2013. The distributive economic impacts of Hawaii's commercial fishery: a SAM analysis. Fisheries Research 145: 82-89. doi:10.1016/j.fishres.2013.02.005.

DOI-2021-08 00624

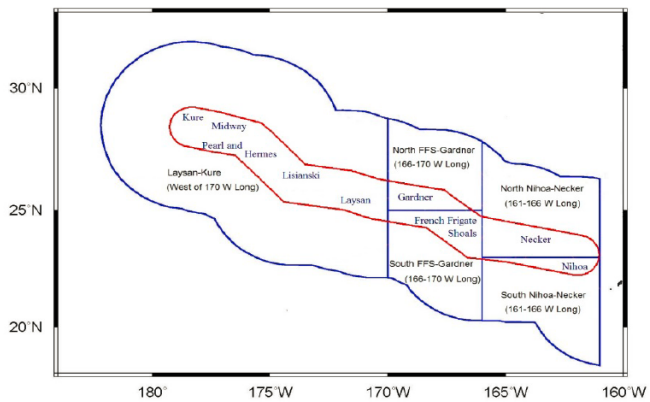
Appendix:
Data Description and Data Tables

Data[5] used in this analysis are included in an attached Excel file. This file includes three tabs: (1) Original, (2) Calculation, and (3) IO.

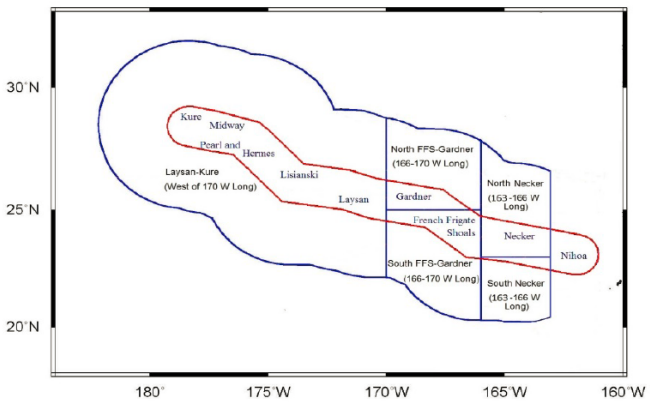
Original: The original tables received from PIFSC International Fisheries Program
Calculation: This tab includes percentage/share calculations, correction factors, inflation-adjustments for revenues, catch composition
IO: This tab includes the economic impact multipliers

Table 1. Longline Pounds Caught (2010-2015) in NWHI areas

Area of NWHI fishing displaced	% longline pounds
Entire NWHI EEZ west of 161 W meridian	9.2%
From 161 to 166 W and North of Islands (North Nihoa-Necker)	2.2%
From 161 to 166 W and South of Islands (South Nihoa-Necker) Combined Deep and Shallow	3.3%
From 166 to 170 W and North of Islands (North FFS-Garder) Deep and Shallow	1.1%
From 166 to 170 W and South of Islands (South FFS-Garder)	1.5%
West of 170 W (Laysan-Kure)	1.1%



Area of NWHI fishing displaced	% longline pounds
Entire NWHI EEZ west of 163 W meridian	6.5%
From 163 to 166 W and North of Islands (North Necker)	1.1%
From 161 to 166 W and South of Islands (South Necker) Combined Deep and Shallow	1.5%
From 166 to 170 W and North of Islands (North FFS-Garder) Deep and Shallow	1.1%
From 166 to 170 W and South of Islands (South FFS-Garder)	1.5%
West of 170 W (Laysan-Kure)	1.1%



Source: PIFSC International Fisheries Program of the Fisheries Research and Monitoring Division , pers. comm. 9/20/2016

[5] See accompanying data file [IR17_MonumentPIFSC.xlsx]

DOI-2021-08 00626

Table 2. Annual average pounds caught (2010-2015) in NWHI, by fishery

DEEP NWHI			Pounds										Shallow NWHI	All NWHI
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**	**Swordfish**	**Blue marlin**	**Striped marlin**	**Spearfish**	**Mahimahi**	**Ono (Wahoo)**	**Moonfish**	**Other**	**All Pelagics**	**All Pelagics**	**All Pelagics**
2010	710,474	149,486	139,928	46,331	33,395	38,437	16,709	10,563	16,853	110,824	123,552	1,396,552	481,545	1,878,097
2011	1,614,411	326,993	400,371	56,400	123,703	159,348	112,908	93,844	31,124	138,955	277,881	3,335,937	384,783	3,720,720
2012	1,392,402	295,427	239,171	64,759	53,293	101,854	44,558	59,377	28,246	136,327	280,153	2,695,566	347,435	3,043,001
2013	1,119,958	244,004	118,836	47,174	77,942	119,641	64,706	46,941	32,602	111,294	187,927	2,171,025	303,133	2,474,158
2014	919,962	155,763	66,061	36,287	53,551	83,593	41,475	17,116	36,591	74,921	151,941	1,637,262	254,040	1,891,302
2015	1,102,391	260,215	94,607	48,442	92,808	123,718	50,101	24,524	31,996	82,240	121,416	2,032,458	257,515	2,289,973
										2010-2015 average		2,211,467	338,075	2,549,542
										Correction Factor (-2 7%)		**2,151,757**	**328,947**	**2,480,704**

Table 3. Annual share of pelagic pounds caught (2010-2015) in NWHI, by fishery

DEEP NWHI PERCENTAGE OF TOTAL DEEP					(based on weight)							
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**	**Swordfish**	**Blue marlin**	**Striped marlin**	**Spearfish**	**Mahimahi**	**Ono (Wahoo)**	**Moonfish**	**Other**	**All Pelagics**
2010	6.0%	12.2%	15.8%	10.0%	4.9%	11.3%	6.4%	1.1%	6.1%	6.2%	7 5%	7%
2011	12.9%	16.0%	26.9%	11.6%	15.0%	20.9%	22.0%	10.8%	8.7%	8.4%	16 1%	14%
2012	10.8%	15.1%	16.8%	11.4%	8.1%	17.1%	12.6%	6.7%	7.6%	8.5%	13 9%	12%
2013	7.8%	15.2%	17.3%	6.9%	8.9%	14.2%	13.8%	5.6%	6.9%	5.3%	8.4%	9%
2014	5.9%	10.9%	14.8%	5.2%	4.6%	9.2%	8.7%	2.1%	5.3%	3.3%	6 9%	6%
2015	5.7%	13.1%	17.9%	5.7%	6.8%	11.6%	8.7%	3.5%	4.1%	3.1%	5 1%	6%
Mean	8.2%	13.7%	18.2%	8.5%	8.0%	14.0%	12.0%	5.0%	6.5%	5.8%	9.7%	9.0%
										correction factor (-2.7%)		**8.7%**

SHALLOW NWHI PERCENT OF TOTAL SHALLOW					(based on weight)							
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**	**Swordfish**	**Blue marlin**	**Striped marlin**	**Spearfish**	**Mahimahi**	**Ono (Wahoo)**	**Moonfish**	**Other**	**All Pelagics**
2010	16.2%	18.9%	1.9%	12.8%	36.5%	38.9%	24.5%	19.3%	69.9%	4.0%	21 3%	13%
2011	22.7%	25.1%	1.2%	9.3%	64.9%	41.4%	36.7%	27.5%	10.5%	0.9%	24 3%	11%
2012	9.5%	19.8%	2.5%	11.2%	54.0%	51.6%	31.6%	21.4%	44.8%	0.4%	23 2%	12%
2013	26.2%	39.0%	1.6%	10.3%	54.8%	74.3%	29.2%	49.9%	30.0%	0.0%	17.0%	13%
2014	4.4%	22.0%	0.6%	7.0%	55.8%	30.1%	11.1%	30.7%	27.9%	0.0%	4.7%	8%
2015	2.8%	13.1%	0.4%	9.2%	24.6%	26.9%	16.3%	36.6%	12.3%	0.0%	4.4%	9%
Mean	13.6%	23.0%	1.3%	10.0%	48.4%	43.9%	24.9%	30.9%	32.6%	0.9%	15.8%	11.1%
										correction factor (-2.7%)		**10.8%**

Table 4. Annual share of fishing effort (2010-2015) in NWHI, by fishery

FISHING EFFORT - DEEP NWHI VERSUS TOTAL DEEP						
Year	**NWHI deep (sets)**	**Total deep (sets)**	**NWHI deep (% sets)**	**NWHI deep (1,000 hooks)**	**Total deep (1,000 hooks)**	**NWHI deep (% hooks)**
2010	1,051	16,065	6.5%	2,415	37,225	6%
2011	2,328	17,167	13.6%	5,423	40,761	13%
2012	2,089	18,101	11.5%	5,067	44,058	12%
2013	1,669	18,732	8.9%	4,141	46,847	9%
2014	1,148	17,756	6.5%	2,856	45,649	6%
2015	1,215	18,519	6.6%	3,081	47,643	6%
Mean	1,583	17,723	8.9%	3,831	43,697	9%
					correction factor (-2.7%)	8.6%

FISHING EFFORT - SHALLOW NWHI VERSUS TOTAL SHALLOW						
Year	**NWHI shallow (sets)**	**Total shallow (sets)**	**NWHI shallow (% sets)**	**NWHI shallow (1.000 hooks)**	**Total deep (1,000 hooks)**	**NWHI deep (% hooks)**
2010	254	1,871	13.6%	274	1,841	15%
2011	164	1,447	11.3%	176	1,468	12%
2012	195	1,352	14.4%	219	1,448	15%
2013	118	961	12.3%	130	1,059	12%
2014	98	1,336	7.3%	111	1,484	7%
2015	110	1,129	9.7%	123	1,258	10%
Mean	157	1,349	11.4%	172	1,426	12%
					correction factor (-2.7%)	11.6%

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Table 5. Annual share of fishing effort (2010-2015) in NWHI relative to total longline fishery

FISHING EFFORT - TOTAL NWHI VERSUS TOTAL FISHERY						
Year	**NWHI (sets)**	**Total (sets)**	**NWHI (% sets)**	**NWHI (1,000 hooks)**	**Total (1,000 hooks)**	**NWHI (% hooks)**
2010	1,305	17,936	7.3%	2,689	39,067	6.9%
2011	2,492	18,614	13.4%	5,600	42,229	13.3%
2012	2,284	19,453	11.7%	5,286	45,506	11.6%
2013	1,787	19,693	9.1%	4,271	47,907	8.9%
2014	1,246	19,092	6.5%	2,967	47,132	6.3%
2015	1,325	19,648	6.7%	3,204	48,901	6.6%
Mean	1,740	19,073	9.1%	4,003	45,124	8.9%
		correction factor (-2.7%)		3,895		

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Table 6. Annual share of species composition of catch (2010-2015), by area and species

TOTAL FISHERY ALL AREAS												
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**	**Swordfish**	**Blue marlin**	**Striped marlin**	**Spearfish**	**Mahimahi**	**Ono (Wahoo)**	**Moonfish**	**Other**	**TOTAL**
2010	50%	5%	4%	15%	3%	2%	1%	4%	1%	8%	7%	100%
2011	47%	8%	6%	13%	3%	3%	2%	3%	1%	6%	7%	100%
2012	50%	8%	6%	12%	3%	2%	1%	4%	1%	6%	8%	100%
2013	52%	6%	3%	10%	3%	3%	2%	3%	2%	8%	8%	100%
2014	52%	5%	2%	12%	4%	3%	2%	3%	2%	8%	7%	100%
2015	55%	6%	2%	10%	4%	3%	2%	2%	2%	8%	7%	100%
Mean	51%	6%	3%	12%	3%	3%	2%	3%	2%	7%	7%	

Total NWHI (Deep+Shallow)												
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**	**Swordfish**	**Blue marlin**	**Striped marlin**	**Spearfish**	**Mahimahi**	**Ono (Wahoo)**	**Moonfish**	**Other**	**All Pelagics**
2010	39%	8%	7%	24%	2%	3%	1%	1%	1%	6%	7%	100%
2011	44%	9%	11%	9%	4%	5%	3%	3%	1%	4%	8%	100%
2012	46%	10%	8%	11%	2%	4%	2%	2%	1%	4%	10%	100%
2013	46%	10%	5%	11%	4%	6%	3%	3%	1%	4%	8%	100%
2014	49%	9%	3%	13%	3%	5%	2%	2%	2%	4%	8%	100%
2015	48%	11%	4%	12%	4%	6%	2%	2%	1%	4%	5%	100%
Mean	45%	10%	6%	13%	3%	5%	2%	2%	1%	4%	8%	

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Table 7. Annual nominal and inflation-adjusted fishery revenues (2010-2015) in NWHI, by fishery

DEEP NWHI			$ K revenue												
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**	**Swordfish**	**Blue marlin**	**Striped marlin**	**Spearfish**	**Mahimahi**	**Ono (Wahoo)**	**Moonfish**	**Other**	**TOTAL**	**CPI**	**CPI Inflator**	**Inflation-Adjusted ($2015)**
2010	$ 2,729	$ 446	$ 154	$ 113	$ 43	$ 77	$ 25	$ 22	$ 41	$ 202	$ 157	$ 4,010	234 869	1 108	$ 4,442
2011	$ 6,355	$ 962	$ 560	$ 137	$ 148	$ 174	$ 81	$ 229	$ 99	$ 317	$ 322	$ 9,383	243 622	1 068	$ 10,020
2012	$ 6,499	$ 1,133	$ 614	$ 169	$ 95	$ 230	$ 78	$ 159	$ 90	$ 332	$ 437	$ 9,836	249 474	1 043	$ 10,258
2013	$ 4,964	$ 1,014	$ 261	$ 112	$ 114	$ 178	$ 57	$ 113	$ 83	$ 238	$ 202	$ 7,334	253 924	1 025	$ 7,514
2014	$ 3,691	$ 595	$ 116	$ 84	$ 85	$ 122	$ 39	$ 45	$ 89	$ 167	$ 168	$ 5,201	257 589	1 010	$ 5,253
2015	$ 4,128	$ 690	$ 153	$ 128	$ 80	$ 104	$ 30	$ 65	$ 68	$ 191	$ 140	$ 5,777	260 165	1 000	$ 5,777
Mean												$ 6,924			$ 7,211
											correction factor (-2.7%)	**$ 6,737**			**$ 7,016**

SHALLOW NWHI			$ K revenue												
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**	**Swordfish**	**Blue marlin**	**Striped marlin**	**Spearfish**	**Mahimahi**	**Ono (Wahoo)**	**Moonfish**	**Other**	**TOTAL**	**CPI**	**CPI Inflator**	**Inflation-Adjusted ($2015)**
2010	$ 98	$ 16	$ 1	$ 1,027	$ 5	$ 14	$ 1	$ 14	$ 3	$ 1	$ 20	$ 1,199	234 869	1 108	$ 1,328
2011	$ 93	$ 40	$ 1	$ 605	$ 15	$ 17	$ 3	$ 42	$ -	$ -	$ 16	$ 832	243 622	1 068	$ 888
2012	$ 33	$ 27	$ 1	$ 778	$ 19	$ 22	$ 2	$ 29	$ 2	$ -	$ 18	$ 931	249 474	1 043	$ 971
2013	$ 59	$ 42	$ -	$ 589	$ 7	$ 24	$ 2	$ 57	$ 1	$ -	$ 3	$ 785	253 924	1 025	$ 804
2014	$ 19	$ 27	$ -	$ 438	$ 6	$ 9	$ -	$ 32	$ 1	$ -	$ 2	$ 534	257 589	1 010	$ 539
2015	$ 14	$ 11	$ -	$ 494	$ 1	$ 4	$ -	$ 32	$ -	$ -	$ 1	$ 558	260 165	1 000	$ 558
Mean												$ 807			$ 848
											correction factor (-2.7%)	**$ 785**			**$ 825**

Table 8. Annual share of nominal fishery revenues (2010-2015) in NWHI, by fishery and species

DEEP NWHI PERCENTAGE OF TOTAL DEEP					(based on revenue)							
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**	**Swordfish**	**Blue marlin**	**Striped marlin**	**Spearfish**	**Mahimahi**	**Ono (Wahoo)**	**Moonfish**	**Other**	**All Pelagics**
2010	5.7%	11.3%	12.1%	9.2%	5.1%	12.5%	7.1%	1.5%	5.6%	8.0%	6.2%	6%
2011	12.1%	15.8%	22.3%	9.7%	14.5%	18.3%	14.6%	10.3%	9.8%	10.6%	11.6%	13%
2012	10.6%	15.1%	18.2%	10.0%	8.1%	17.7%	12.1%	7.1%	7.7%	10.2%	12.0%	11%
2013	7.9%	15.5%	15.8%	6.4%	9.3%	16.4%	10.1%	6.0%	6.5%	7.3%	6.3%	9%
2014	6.1%	11.6%	13.1%	4.8%	5.7%	9.3%	8.1%	2.9%	6.2%	5.0%	5.5%	6%
2015	5.6%	11.7%	17.4%	5.9%	5.7%	8.4%	5.8%	3.6%	4.1%	4.6%	4.0%	6%
Mean	8.0%	13.5%	16.5%	7.7%	8.1%	13.8%	9.6%	5.2%	6.7%	7.6%	7.6%	8.5%
											correction factor (-2.7%)	**8.3%**

SHALLOW NWHI PERCENT OF TOTAL SHALLOW					(based on revenue)							
Year	**Bigeye tuna**	**Yellowfin tuna**	**Albacore**	**Swordfish**	**Blue marlin**	**Striped marlin**	**Spearfish**	**Mahimahi**	**Ono (Wahoo)**	**Moonfish**	**Other**	**All Pelagics**
2010	20.6%	19.5%	4.2%	13.7%	35.7%	36.8%	50.0%	23.0%	60.0%	6.7%	25.3%	14%
2011	23.3%	30.3%	1.6%	7.6%	68.2%	34.0%	37.5%	26.1%	0.0%	0.0%	27.6%	9%
2012	8.9%	19.1%	3.1%	10.8%	55.9%	50.0%	28.6%	24.4%	66.7%	0.0%	26.5%	12%
2013	25.0%	33.9%	0.0%	8.4%	50.0%	66.7%	33.3%	55.3%	50.0%	0.0%	11.1%	10%
2014	5.5%	25.0%	0.0%	7.1%	50.0%	23.1%	0.0%	31.4%	33.3%	0.0%	5.3%	8%
2015	2.8%	15.3%	0.0%	8.1%	20.0%	21.1%	0.0%	37.2%	0.0%	0.0%	3.4%	8%
Mean	14.4%	23.9%	1.5%	9.3%	46.6%	38.6%	24.9%	32.9%	35.0%	1.1%	16.5%	10.3%
											correction factor (-2.7%)	**10.0%**

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Table 9. Indirect economic impact multiplier structure using 2015 NWHI fishing revenues

Direct value						
Hawaii longline revenue in 2015 ($million)		104.278				
Indirect value			Total Impact		NWHI impact	
Backward Linkage (the non-fishery sectors)		Multiplers	Revenue	Linkage	Revenue	Linkage
	Tuna	1.44	97.403	140.260	5.777	8.319
	Tuna/Swordfish	1.326	6.875	9.116	0.558	0.740
	Total		104.278	149.377	6.335	9.059
Household Income						
multiplers				Linkage	Revenue	Linkage
	Tuna	0.673	97.403	65.552	5.777	3.888
	Tuna/Swordfish	0.651	6.875	4.476	0.558	0.363
	Total		104.278	70.028	6.335	4.251
Job			Revenue	Linkage	Revenue	Linkage
per one million	Tuna	12	97.403	1,168.836	5.777	69.324
	Tuna/Swordfish	11	6.875	75.625	0.558	6.138
	Total		104.278	1,244.461	6.335	75.462
Tax Revenue			Revenue	Linkage	Revenue	Linkage
per one million	Tuna	0.089	97.403	8.669	5.777	0.514
	Tuna/Swordfish	0.084	6.875	0.578	0.558	0.047
	Total		104.278	9.2	6.3	0.6

Driect Value	Entire industry	NWHI	Units
Hawaii longline revenue in 2015	104	6.335	Millions
Indirect Value (Backward linkage sectors, such as fuel & gear supplies, dry dock services, etc.)			
1. Total Impact on Industries	149	9.059	Millions
2. Household Income	70	4.251	Millions
3. Job	1244	75	Jobs
4. Tax Revenue	9	0.561	Millions

Mutiplers are based on the study (in Table 6) by Arita, S. M. Pan, J. Hospital, and PS Leung. 2011. Contribution, Linkages and Impacts of the Fisheries Sector to Hawaii's Economy: A Social Accounting Matrix Analysis, JIMAR Contribution 11-373, University of Hawaii