Alternatives to Address Excess Capacity in the Eastern Pacific Purse Seine Tuna Fishery

Final Report

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Abbreviations

ACL	annual catch limits
AIDCP	Agreement on the International Dolphin Conservation Programme
BET	bigeye tuna
BTSD	between trip shore days
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CPC	A collective term representing member countries of the IATTC
DAS	days-at-sea
DEL	dolphin set
DML	dolphin mortality limit
EEZ	Exclusive Economic Zone
EM	electronic monitoring
EPO	Eastern Pacific Ocean
E.U.	European Union
FAD	fish aggregating device
ISSF	International Seafood Sustainability Foundation
IVQ	individual vessel quota
IATTC	Inter-American Tropical Tuna Commission
IBSM	Interactive Buyback Spreadsheet Model
m^3	cubic meters
MFR	Marine Fauna Report
Mt	metric tons
NEI	Northern Economics, Inc.
NOA	unassociated tuna set
NOR	net operating revenues
OBJ	floating object set
OPP	Ocean Partnerships for Sustainable Fisheries and Biodiversity Conservation Program
PBF	Pacific bluefin tuna
PVFE	present value of future earnings
RMFO	Regional Fishery Management Organization
SDO	Social Development Organization
SKJ	skipjack tuna
SMOD	sustainable maximum operating days
SQ	status quo
STVL	Small Tuna Vessel Limit
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	Western and Central Pacific Ocean
WWF-US	World Wildlife Fund-US
YFT	yellowfin tuna

1 Introduction

This document contains a technical analysis on the methods and alternative means to manage purse seine fleet capacity in the tropical tuna fishery of the Eastern Pacific Ocean (EPO). The substantial growth of fishing capacity of the tuna purse-seine fleet operating in the EPO in the last two decades has led to a current fleet capacity that is considerably in excess of the target level 158,000 cubic meters (m^3) of well volume adopted by the Inter-American Tropical Commission (IATTC) in August 2000. In 2016 the total operative capacity was 264,859 m^3 and potential total capacity was 296,415 m^3.

This consultancy is funded through the World Bank's Global Environment Facility's Areas beyond National Jurisdiction Ocean Partnerships for Sustainable Fisheries and Biodiversity Conservation Program (OPP). The OPP has as an objective to catalyze pilot investment into selected transformational public-private partnerships that mainstream the sustainable management of highly migratory fish stocks spanning areas within and beyond national jurisdictions. The OPP is structured around four regional projects, each developing a business plan, based on innovative incentive-based tools, for improving management of fisheries that intersect with areas beyond national jurisdiction. WWF-US is the Executing Agency for a regional project in the EPO that includes this consultancy and the work of a Global Think Tank.

One component of the OPP-EPO is the technical analyses of options relevant to the development of an IATTC capacity management plan as required under IATTC resolution C-02-03. The urgency in addressing capacity is best summarized in a 2014 report of an IATTC technical experts workshop in Cartagena, Colombia: "The substantial growth of the fishing capacity of the tuna purse-seine fleet operating in the eastern Pacific Ocean (EPO) in the last two decades has led to a current fleet capacity that is considerably in excess of the target level of 135,000 metric tons (equivalent to 158,000 cubic meters (m^3) of well volume) adopted by the Commission in August 2000." Therefore, the current level of capacity is greater than the optimal level required to sustainably harvest the tropical tuna resources in the EPO, considering the status of the stocks. This situation is cause for concern, and since 2004, measures have been implemented to restrict purse-seine fishing effort, primarily by time and area closures, and by limiting longline catches of bigeye tuna (BET). However, the IATTC understands fleet capacity must be addressed, and passed a resolution to implement an EPO-wide capacity management plan that is currently under development, and the analyses and results derived from the OPP-EPO will be important inputs to the drafting of that plan.

Since 2002, with the IATTCs approval of Resolution C-02-03 on the *Capacity of the Tuna Fleet Operating in the Eastern Pacific Ocean,* operative capacity in the EPO purse seine fleet has increased from ≈ 200,000 m^3 to ≈ 261,000 m^3 in 2016, a 1.7 percent annual rate of growth. Since 2013, however, operative capacity has grown at a much higher 5.6 percent annual rate due to the "activation" of ≈ 46,000 m^3 of capacity in 2014–2015. Furthermore, there is ≈17,000 m^3 of available capacity that can become operational, and new applications, claims, and disputes regarding capacity continue to arise.

Overcapacity in the EPO purse seine fleet, and concerns about the continued sustainability of the BET and yellowfin tuna (YFT) stocks has led the IATTC to enact closure periods in the fishery. As summarized in the introduction of Chapter 2 (page 8), closure periods were first enacted in 2002 with a fleetwide closure during the month of December. In 2003–2008, the closure period was expanded to 42 days, and in 2009, the closure period was expanded to 59 days. From 2010 to 2017 the closure period was set at 62 days, but in 2017 the IATTC approved Resolution 17-02-01[1] that increases the 62-day closure period to 72.

[1] IATTC Resolution C-17-02. *Conservation Measures For Tropical Tunas In The Eastern Pacific Ocean During 2018-2020* and *Amendment too Resolution C-17-01*. Available online at www.iattc.org/PDFFiles/Resolutions/_English/C-17-02-Tuna-conservation-in-the-EPO-2018-2020-and-amendment-to-Res.-C-17-01.pdf

Apart from the effects of increasing the seasonal closure, further increases in capacity will have other substantial negative socioeconomic effects, especially impacting EPO coastal countries that have developed and invested in the complete operation of the tuna chain of production and marketing. Thus, it is critical to design and develop strategies that seek to reduce this fishing pressure on tuna catches in the EPO—the primary focus of this consultancy.

Northern Economics Inc. (NEI) an economics consulting firm based in Anchorage, Alaska (USA) is the lead consultant for the project and Marcus Hartley, NEI President is the principal investigator, while Dr. Santiago Bucaram, until recently the Director del Centro de Investigaciones Económicas at Escuela Superior Politécnica del Litoral is the Technical Advisor. Together Northern Economics and Dr. Bucaram are referred to as the NEI Team.

Organization of the Report

The remainder of this document contains three chapters followed by three appendices:

Chapter 2 contains a summary of existing conditions in the EPO purse seine fishery. The chapter begins with an overview of the IATTC and a description of the data used in the development of the analysis. This is followed by a review of the primary indicators of capacity utilization including summaries of active vessels and capacity, trip lengths and harvests by species. The NEI Team then reviews price data used in the analysis and summarizes gross revenues in the fishery. Finally, Chapter 2 estimates operating costs for the purse seine fleet and develops estimates of net operating revenues (gross revenues minus estimated operating costs) in the fishery.

Chapter 3 provides a quantitative assessment of the cost of over-capacity under the status quo. Costs of overcapacity are developed from three perspectives: 1) estimated cost of the 72-day closure period in future years; 2) the estimated cost of the historical 62-day closure periods, and 3) the cost of excess capacity in terms of additional closure days that would be required if all current vessels maximized their effort in the fishery.

Chapter 4 provides both qualitative and quantitative assessments of potential ways to address or begin to address overcapacity in the EPO purse seine fishery. Qualitative assessments are provided for three alternatives, while quantitative assessments are provided for five alternatives including a vessel buyback program and individual vessel quota (IVQ) program.

The remainder of this introduction provides a summary of the project's Advisory Committee Meeting and the Project's Inception Report along with a full list of the capacity reduction alternatives that are presented.

The Advisory Committee Meeting, October 2017 in La Jolla and the Inception Report

This section provides an overview of the Advisory Committee meeting that was held in La Jolla, CA at the Scripps Seaside Forum on October 9 and 10, 2017. The Advisory Committee was formed to provide project guidance and a solid basis on the issues facing the fishery. The Advisory Committee also played a key role in the determination of specific alternatives that would be analyzed.

Members of the Advisory Committee include:

- Guillermo Compeán, IATTC
- Jean-Francois Pulvenis, IATTC
- Rick Deriso, IATTC
- Alexandre Aires-Da-Silva, IATTC

- Mark Maunder, IATTC
- Vishwanie Maharaj, World Wildlife Fund
- Dale Squires, NOAA Fisheries
- Joshua Graf-Zivin, University of California-San Diego
- Kelly Wachowicz, Catch Invest
- Angela Martini, European Union
- Marcus Hartley, Northern Economics
- Don Schug, Northern Economics
- Santiago Bucaram, Universidad San Francisco de Quito

The Advisory Committee Meeting comprised two sections: 1) a discussion of the EPO purse seine fishery, its management and the major issues faced by the IATTC; and 2) a discussion and selection of potential management alternatives for inclusion in this study.

Background on the EPO Purse Seine Fishery and Major Issues Facing the IATTC

The background information presented at the Committee meeting included the following topics:

1) Capacity definitions and capacity levels in EPO purse seine fishery;
2) Stock assessment in the EPO and sustainability issues resulting from excess capacity in the EPO purse seine fishery
    a. Particular focus was given to difficulties in determination of harvests levels of small BET and YFT, given that the two species are nearly indistinguishable when they are less than 2.5 kg.
    b. The issue of increasing harvests of sub-adult BET and YFT was also discussed, with an emphasis of increasing risk to long-term sustainability of stocks;
3) Methodologies used by the IATTC staff to assess capacity growth and to guide recommendations of management measures to IATTC members;
4) Potential methodologies to assess the current cost of excess capacity.

Discussion and Selection of Capacity Management Alternatives for Inclusion in this Study

The Committee was provided a summary of management measures that could potentially be included for analysis. The list was developed by the NEI Team based in part on options discussed at the Cartagena Workshop held in 2014 and options presented by Commission members separately and as part of the IATTC Capacity Committee's recommendations. A suite of several alternatives was determined appropriate for the study, and the NEI Team was asked to include these alternatives in an Inception Report that would be provided to and reviewed by the Advisory Committee.

The alternatives selected included:

1) A vessel buyback program
2) A phased-in capacity reduction program that would reduce capacity by 10 percent per year
3) An Individual Vessel Quota Program
4) Annual limits on the harvest of small BET and YFT
5) A series of "small steps" that, while perhaps not directly affecting capacity, could be approved by the IATTC and would facilitate approval and implementation of more significant measures.

In addition to the list above, several other alternatives were provisionally included pending future analysis within the Inception Report which the NEI Team developed the following the Advisory Committee Meeting. The inception report included an initial summary of existing conditions, as well as initial investigations into the suite of alternatives proposed for inclusion in this Final Report. Development of the Inception Report was a critical step in refining the final suite of alternatives for inclusion in this final report, as it provided the NEI Team a means to determine whether and how the full suite of alternatives could be assessed. Within the Inception Report it was determined that a total of eight alternatives would be addressed. The final suite of alternatives that are analyzed in this report are summarized below.

Final Suite of Alternatives for Analysis

A total of eight capacity reduction programs and initiatives are assessed in this report—three are assessed in a qualitative manner and five are assessed quantitatively. In addition, following the qualitative assessments, the NEI Team includes a summary description of alternative ways that countries can benefit from the purse seine fishery without increasing fleet capacity.

The three qualitatively assessed capacity reduction programs are as follows:

1) Adoption of elements of Japan's proposal to the IATTC in 2013[2] that whenever there is a request to reassign capacity to a different vessel, some percentage of the capacity must be removed from the Regional Vessel Register;
2) Implementation of a "small Steps" initiative discussed during the October Advisory Committee meetings. Collectively these small steps could set the stage for additional actions that could significantly reduce capacity;
3) A program that would freeze current latent capacity on the vessel register until fleet capacity is reduced to the optimum.

The five quantitatively assessed capacity reduction programs are as follows:

4) A Vessel/Capacity Buyback Program;
5) IATTC Member States Reduce Operative Capacity by 10 Percent per Year and Freeze that Capacity until Total Capacity reaches Optimum Level;
6) Voluntary Capacity Reduction Pilot Programs;
7) A Transferable Individual Vessel Quota Program;
8) Annual Small Tuna Vessel Limits for BET and YFT.

[2] The full text of the proposal is available at http://www.iattc.org/Meetings/Meetings2013/Jun/_English/IATTC-85-PROP-H-2-JPN-Management-of-fishing-capacity.pdf.

2 Summary of Existing Conditions of the EPO Purse Seine Fleet

Chapter 2 provides a summary of existing conditions of the EPO Purse Seine Fleet and is divided into two sections:

Section 2.1 provides a summary of the harvest and activity data provided by the IATTC

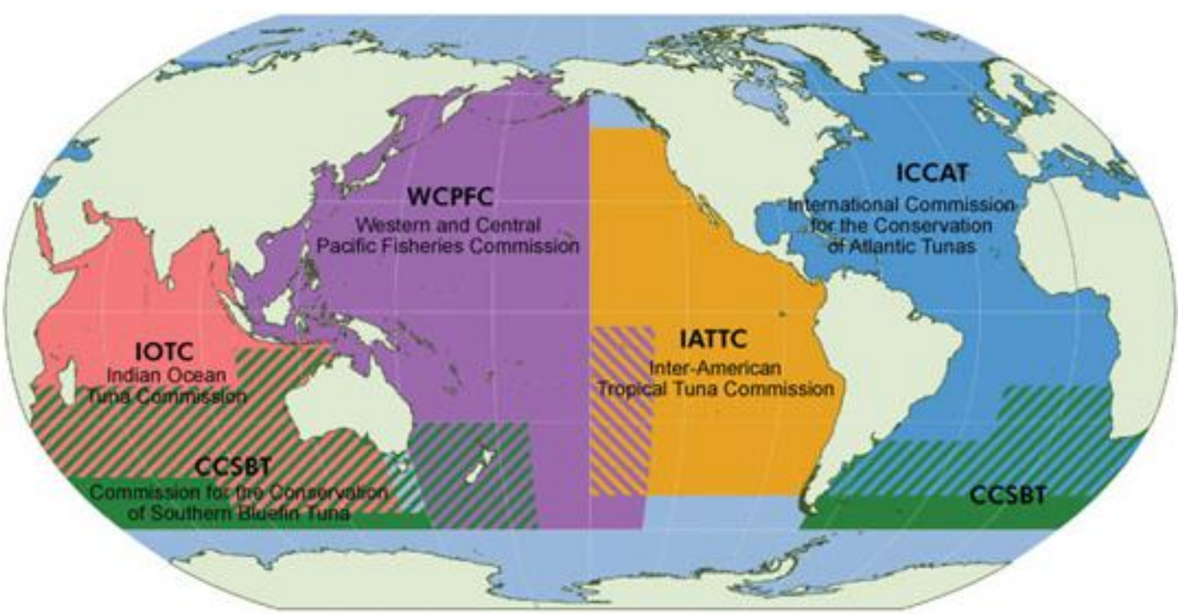
Section 2.2 provides a summary of cost and price information collected from sources outside the IATTC and combines price and cost data with harvest and activity data to estimate total revenues, total costs, and total net operating revenues for the EPO Fleet.

The remainder of this introductory section provides brief summary of the IATTC with a focus on the IATTC capacity management. This is followed by along key terms and definitions and analytical protocols used in this analysis.

Inter-American Tropical Tuna Commission

The IATTC is one of five Regional Fishery Management Organizations (RFMOs) that manage the tuna fisheries around the world. Three of these RFMOs manage tuna in the Pacific Ocean, the IATTC, Western and Central Pacific Fisheries Commission (WCPFC), and the Commission for the Conservation of Southern Bluefin Tuna (CCSBT). As shown in Figure 1 the IATTC manages tuna fisheries in the **EPO**, which while the WCPFC is primary RFMO for tuna in the **WCPO**. The IATTC's jurisdiction comprises the area from 50° North to 50° South and on out to 150° westward of North, Central and South America. Figure 1 also shows portion of the south Pacific that is jointly managed by the WCPFC and the IATTC—this area is bounded runs 5° S. to 5° South and from 130° W 150°. Tuna landed in this jointly managed area are reported to both the WCPFC and the IATTC.

Figure 1. Regional Fishery Management Organizations for the Management of Tuna



Source: From http://www.pewtrusts.org/en/research-and-analysis/fact-sheets/2012/02/23/faq-what-is-a-regional-fishery-management-organization

The IATTC is comprised of twenty-one member-states and five cooperating non-members, all of which are referred to collectively as **CPCs**. Table 1 lists all CPCs that are comprised by the IATTC. The IATTC has management jurisdiction in International waters for tuna fisheries. CPCs with Exclusive Economic Zones (EEZ) falling with within the EPO retain management of their fishing activities within their EEZs, but by their participation they also agreed to abide by IATTC resolutions as they apply to fisheries with their EEZs.

The IATTC operates on a consensus basis with action taken only if there is unanimous consent. The primary duties of the IATTC are: 1) to study the biology of the tunas, tuna baitfishes, and other kinds of fish taken by tuna vessels in the EPO and the effects of fishing and natural factors upon them, and 2) to recommend appropriate conservation measures, when necessary, so that these stocks of fish can be maintained at levels which will afford the maximum sustained catches. Since 1976, the IATTC has also agreed to "… maintain [dolphin] stocks at or above levels that assure their survival in perpetuity, with every reasonable effort being made to avoid needless or careless killing of [dolphins]" (33rd meeting of the IATTC (October 11-14, 1976).

Table 1. IATTC Member States and Cooperating Non-Members

IATTC Member States						
Belize	Canada	China	Chinese Taipei	Colombia	Costa Rica	Ecuador
El Salvador	European Union	France	Guatemala	Japan	Kiribati	Korea
Mexico	Nicaragua	Panama	Peru	United States	Vanuatu	Venezuela

Cooperating Non-Members				
Bolivia	Chile	Honduras	Indonesia	Liberia

Gears under the jurisdiction of the IATTC

In general, the IATTC manages tuna fisheries within its jurisdiction on a gear-by-gear basis. These gears include purse seine, longline, troll, pole and line, and several other commercial gear types. Since 2007 approximately 75 percent of the all tuna harvests in IATTC waters were taken by purse seines, while another 16 percent has been taken by longlines.

Capacity Management

Since 2002, the primary means of management of the purse seine fishery has been through the limitation of capacity. This was accomplished under Resolution C-02-03, which created a target capacity level of 158,000 m^3 of vessel hold space, and to use the Vessel Register (created under Resolution C-00-06 in June 2000), as the "definitive list of purse seine vessels authorized by the participants to fish for tunas in the EPO." The resolution goes on to state that "the Register shall include only vessels that have fished in the EPO before 28 June 2002."

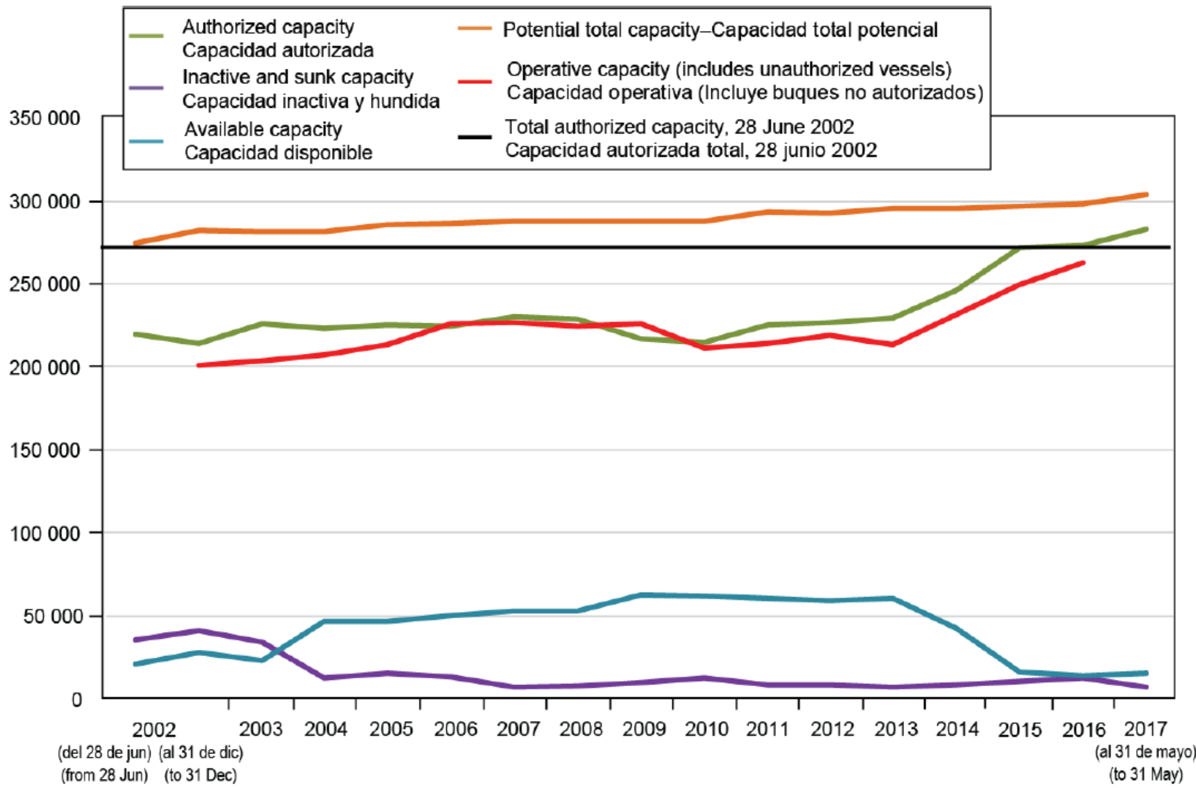
The resolution allows vessels already on the Register to be certified and corrected with respect to capacity of each vessel and prohibits the entry of new vessels "except to replace vessels removed from the Register, and provided that the total capacity of any replacement vessel does not exceed that of the vessel or vessels replaced."

Notwithstanding earlier language of the resolution, paragraph 10 of the Resolution C-02-03 may allow Costa Rica, El Salvador, Nicaragua, and Peru to collectively add 18,720 m^3 of capacity to the register, noting also that the footnote to paragraph 10 in C-02-03 states that Costa Rica, Columbia, and Peru all maintain additional long-term capacity requests totaling 44,514 m^3.

Finally, in paragraph 12, the resolution allows up to 32 vessels from the U.S. that are authorized and licensed by other RFMO's (e.g. WCPFC) in the Pacific to take a single trip in the EPO not to exceed 90 days. Vessels that participate under this exemption are often referred to as Paragraph 12 vessels.

Figure 2, which is reproduced from IATTC document CAP-18-03 *Utilization of Vessels Capacity Under Resolutions C-02-03, C-12-06, C-12-08, and C-15-02,* summarizes capacity in the purse seine fleet since 2002 by capacity type.

Figure 2. Authorized, Inactive, Available, Potential Total, and Operative Capacity (m^3), 2002–2017



Source: Reproduced from IATTC Document CAP-18-03 (2016)

The IATTC defines the following six types of capacity, listed from bottom to top reading up the left-hand side of Figure 2 and noting that the definitions are adapted directly from the glossary of terms in CAP-13-03.

1) **Available Capacity** (the blue line in Figure 2): the total well volume (m^3) that a CPC has available for allocation to vessels as a result of: (a) vessels being removed from the Regional Register; (b) changes of flag, considering that a CPC may choose to retain for future use the right to the capacity of a vessel that is transferred to another flag; (c) non-allocated residuals from transfers and movements of vessels on the Regional Register; (d) the national capacity allocations specified in paragraph 10 of Resolution C-02-03.

   The NEI Team notes that "Available Capacity" fell from ≈60,000 m^3 in 2013 to ≈17,000 m^3 in 2015.

2) **Inactive/sunk capacity** (the purple line in Figure 2): The total well volume (m^3) of (a) vessels that are on the IATTC Regional Register and have declared that they will not fish during a given year,

but retain the right to become active provided they remain on the Regional Register, or (b) vessels that have sunk.

3) **Operative capacity** (the red line in Figure 2). For a completed year this is the total well volume (m^3) of all vessels which fished for tuna in the EPO in that year. For uncompleted years (e.g. 2016 & 2017 in Figure 2) estimates are based on expected capacities based on capacity in the most recent completed year. The following criteria apply in the calculation of operative capacity for a completed year:

    a. Vessels include those that made at least one EPO set with catch during that year.

    b. Only one quarter of the capacity of vessels operating under the special allowance in paragraph 12 of resolution C-02-03 is added to the total, since these vessels will have effectively fished for approximately one quarter of the fishing year only.

    c. If a vessel's capacity changes during the completed year, then the capacity at the end of the year is used.

    The NEI Team notes that the significant growth in Operative Capacity in 2014 and 2015 corresponds to the reductions in "Available Capacity" in those same years.

4) **Authorized Capacity** (the green line in Figure 2): The total well volume (m^3) of vessels that are on the IATTC Regional Register and are authorized to fish in the EPO. Authorized capacity includes vessels that are on the IATTC Regional Register, and which are not listed as "inactive or sunk vessels" but which did not fish for tuna in the EPO during the year.[3]

5) **Total Authorized Capacity as of June 28, 2002** (the black horizontal line in Figure 2): This is the capacity that was officially recognized when C-03-02 was approved. It is the sum as of June 28, 2002 of the "Authorized Capacity" (green line), "Inactive/Sunk Capacity" (purple line) and "Available Capacity" (blue line).

6) **Potential Total Capacity** (the orange line Figure 2): The sum of authorized capacity, inactive/sunk capacity, and available capacity over time. The total well volumes (m^3) that would be operating in the EPO if all CPCs activated all their vessels and used all their available capacity (including inactive/sunk capacity) to bring new vessels into the fishery.

The NEI Team notes that as of November 27, 2017, the Authorized Capacity in the IATTC Vessel Register included 283,805 m^3 of well volumes. The NEI Team also notes that additional detail regarding operative capacity in the purse seine fleet will be provided in later parts of section 2.

Closure Periods

In 2002, the IATTC implemented a 31-day closure period during the month of December for all purse seine vessels in order to limit harvests and help maintain stocks of Bigeye and Yellowfin Tuna at sustainable levels.[4] During a vessel's closure period, the vessel may transit through EPO waters, and may actively fish in non-EPO waters (e.g. the WCPO).

In 2003, the closure period was expanded to 42 days from August 1–September 11, and in 2004 vessels were allowed to choose between two 42-day closure periods (August 1–September 11 or November 20–December 31). The closure periods were expanded to 59 days in 2009 and to 62 days in 2010. Beginning in 2009, small vessels in Classes 1–3 (< 213 m^3) were exempted from the closure periods, while Class 4

[3] The NEI Team defines this group of vessels as **Latent Vessels** (see page 7).

[4] See IATTC Resolutions C-02-09 BET YFT, C-03-12, C-04-09, C-06-02, C-09-01, C-10-01, C-11-01, C-13-01, C-17-02 at https://www.iattc.org/ResolutionsENG.htm for additional details on closures.

vessels (213–318 m^3) were authorized to take one trip no longer than 30 days during the closure period. (IATTC Vessel classes are described on the following page).

No additional changes to closure periods were made until 2018, when the periods were extended to 72 days. The small vessel exemption described in the previous paragraph continues in 2018.

Other Key Terms, Definitions and Analytical Protocols Used in this Report

This subsection provides definitions for key terms used throughout the remainder of this report.

Vessel Classes and Capacity Bins

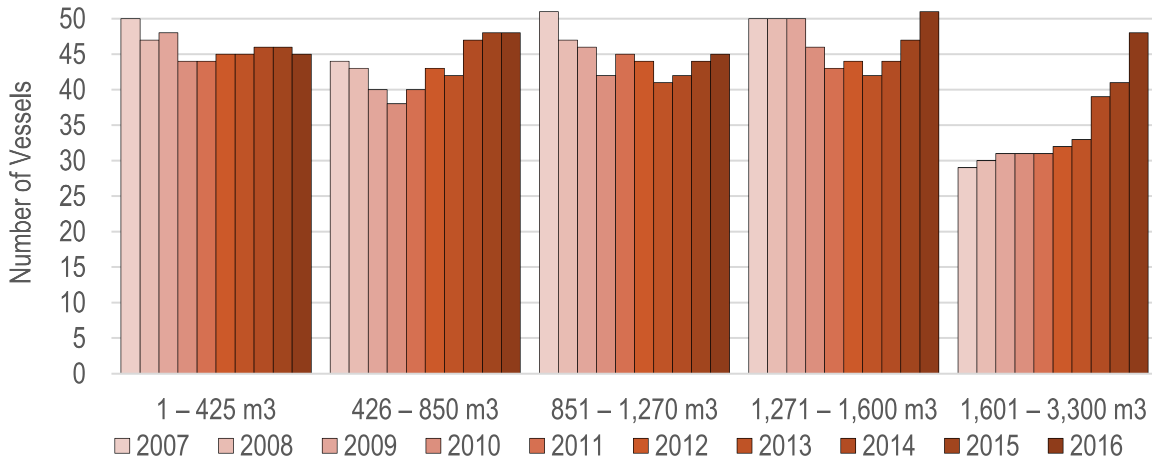
The IATTC categorizes vessels into six classes based on well volumes as summarized in Table 2. Since 2007, an average of 79 percent of all purse vessels have been Class 6 vessels and therefore IATTC vessel classes are not convenient for describing the effects on the purse seine fleet in this analysis. Instead the NEI Team uses capacity bins that combine classes 1–5, and then sub-divide Class 6 into four groups. Counts of vessels by these capacity bins are summarized in Figure 3 below. As is readily seen, these capacity bins categorize the entire fleet into reasonably equal-sized bins, particularly from 2014 to 2016, when the largest capacity bin (1,601–3,300 m^3) increased from 33 vessels to 48 vessels.

Table 2. IATTC Vessel Size Categories and Operative Purse Seine Vessel Counts, 2007–2016

Vessel Class	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Well Volume	0–53 m^3	54–107 m^3	108–212 m^3	213–318 m^3	319–425 m^3	426 + m^3
2007	-	4	11	21	14	174
2008	-	3	9	20	15	170
2009	1	4	9	17	17	167
2010	-	1	8	19	16	157
2011	-	2	9	18	15	159
2012	-	-	8	22	15	163
2013	-	-	5	23	17	158
2014	-	-	5	24	17	172
2015	-	-	3	26	17	180
2016	-	-	3	25	17	192
Average	**0.1**	**1.4**	**7.0**	**21.5**	**16.0**	**169.2**

Source: Developed by Northern Economics using IATTC data.

Figure 3. Counts of Vessels in Capacity Bins, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Set Type

The IATTC harvest data categorized purse seine fishing activity using three types of purse seine sets:

- **FAD Sets (OBJ sets)**: purse seine sets that are made on and around Fish Aggregating Devises (FADs) or other floating objects (debris piles or logs for example).
- **Dolphin Sets (DEL sets)**: sets that are made around schools of dolphins. A special dolphin permit is required to set on dolphins and vessels are required release dolphins unharmed.
- **Unassociated Sets (NOA sets)**: sets that are not directly associated with FADs or dolphins.

Vessel Types

Operative vessels are categorized in this report as either FAD vessels or Dolphin Vessels based on their predominant set type during the fishing year. The distinction between FAD vessels and Dolphin vessels is a major topic throughout this report because of the differences in operating characteristics, primary harvest species, and principal countries of origin. A third category of vessels (Latent Vessels) are also defined.

- **Dolphin vessels**: purse seine vessels which, during the year make 50 percent or more of their sets on dolphins.[5]
- **FAD vessels**: purse seine vessels which, during the year make 50 percent or more of their sets on FADs or as NOA Sets.
- **Latent Vessels**: purse seine vessels which are "authorized" to fish in the EPO by virtue of their presence on the IATTC Register, but which did not fish in the EPO during a given year. Because these vessels by definition did not make sets they are neither FAD vessel or Dolphin vessel.

The NEI Team notes that vessels can be defined as a FAD vessel one year and a Dolphin vessel in another year. Similarly, a vessel may be latent one year and a FAD or Dolphin vessels in another year.

[5] Dolphin vessels must also have been issued a DML under the auspices of the Agreement on the International Dolphin Conservation Programme (AIDCP).

Country Types

Three Country Types are defined by the NEI Team, noting that a given country may be classified differently in different periods. The three country types are listed below are used by the NEI Team in lieu of reporting the encrypted country codes provided in the data by IATTC, in order to comply with non-disclosure agreements and to avoid potentially sensitive conclusions.

- **Dolphin country**: A country for which more than 80 percent of its gross revenue was generated from Dolphin vessels during a given period. Many of the results of this report use data from the 2014–2016 period. During those three years, Dolphin countries included El Salvador, Venezuela, and Mexico.
- **FAD country**: A country for which 80 percent or more of its gross revenue was generated from FAD vessels during a given period. During the 2014–2016 period, FAD countries included Ecuador, Spain, United States (U.S.), Peru, and one other unknown country.
- **Mixed country**: A country for which more than 20 percent of its gross revenue was from Dolphin vessels and more than 20 percent of its gross revenue was from FAD vessels during a given period. During the 2014–2016 period, Mixed countries included Columbia, Panama and Nicaragua.

Currency, Currency Formats, and Nominal v. Real Monetary Value

The NEI Team uses U.S. Dollars for all monetary values. This document uses standard accounting formats when showing monetary values. Thus, negative dollar amounts numbers will be denoted in parentheses and in red text, e.g. ($1,692), rather than as -$1,692.

Type of Days

This analysis describes several types of days as key indicators of activity and of regulatory impacts.

- **Departure Date** is the date on which the purse seine fishing vessel leaves port to begin a fishing trip. Information was provided by the IATTC for all purse seine trips in which the vessel harvested tuna from waters of the EPO. Trips in which the vessel did not harvest fish from the EPO were not included in the data.
- **Arrival Date** is the date on which the purse seine fishing vessel arrives back in port at the end of a fishing trip.
- **Days at Sea** (DAS) are the number of days between the departure date and the arrival date for a given trip. DAS = *Arrival Date – Departure Date + 1.*
- **EPO DAS** are the number of DAS during a trip that the vessel was physically located in the EPO. These data were compiled by the IATTC based on observer day, logbook data and data from vessel transponders.
- **Non-EPO DAS** are that number of DAS during a trip in which the vessel was not physically located in the EPO. For a given trip, *EPO DAS + Non-EPO DAS = DAS.*
- **Fishing Days** are days in which the vessel is actively setting gear or actively searching for fish. A vessel that is transiting is not incurring fishing days. These data are reported by observers and in vessel logbooks but were not made available for use in this report.
- **Between Trip Shore Days** (BTSD) are the days between trips following the Arrival Date of the vessel from a trip and its next Departure Date. *BTSD = Departure Date of Next Trip – Arrival Date of Previous Trip – 1.*

- **Shipyard Days** are the days a vessel spends undertaking annual maintenance. Shipyard days are not reported in the data. The NEI Team assumes that all vessels that are operating on a sustainable basis will take a 30-day period for Shipyard days.[6]
- **Closure Days** are the successive non-fishing days that the IATTC has required of vessels operating in the EPO purse seine fishery as the IATTC's primary capacity management tool. During a vessel's closure period, the vessel may transit through EPO waters, and may actively fish in non-EPO waters (e.g. WCPO). It is assumed (with confirmation from members of industry) that most sustainably managed vessels take their Shipyard Days during the closure period.

2.1 Overview of Harvest and Activity Data Provided by the IATTC

This section provides an overview of the IATTC data provided to the NEI Team only for use in this study. The raw data obtained from the IATTC show set-by-set data for individual vessels for the years 2007–2016. A total of 291,098 records of EPO sets are included in the data, comprising 11,645 separate purse seine trips. The IATTC collected these data and made them available to the NEI study team. As a prerequisite to obtaining these data, the NEI Team signed a non-disclosure agreement with the IATTC which stipulates that before any release of the data, all information will be aggregated so as not to describe individual vessels, and to protect information on the flag countries that have fewer than three active vessels. All the data that were obtained from the IATTC were provided with encrypted vessel identifiers and encrypted identifiers for flag country of the vessel. As such, the data cannot by easily attributed to any individual vessel in the IATTC Vessel Registry. A list of the data fields obtained in the set-by-set data and their descriptions are shown in Table 3.

[6] During discussions with industry, the question of the whether the assumption that a minimum of 30 Shipyard days was reasonable was considered. Industry indicated that it was reasonable, and that currently owners are utilizing a portion of the closure period for annual maintenance.

Table 3. Fields Included in the Harvest Data Provided to the NEI Team

Data Field	Description
TripID	Trip identifier
VesselID	Vessel identifier
FlagID	Country identifier
Length	Vessel length overall (m)
Beam	Vessel width (m)
Depth	Vessel depth (m)
GrossWt	Gross tonnage (metric tonnes)
EngineHP	Engine power (horsepower)
CMCapacity	Cubic meter capacity (m^3)
DepDate	Trip departure date
ArrDate	Trip arrival date
SetDate	Date of the set
SetType	Type of set: DEL=dolphin set, NOA=unassociated tuna set, OBJ=floating object set
LatC1	Center of 1 degree cell of the latitude. Positive value is north of equator, neg. is south.
LonC1	Center of 1 degree cell of the longitude. Pos. value is north of equator, negative is south.
ALB	Albacore *(Thunnus alalunga)* – metric tons of harvest in set
BET	Bigeye *(Thunnus obesus)* – metric tons of harvest in set
BKJ	Black skipjack *(Euthynnus lineatus)* – metric tons of harvest in set
BZX	Eastern Pacific and striped bonito *(Sarda chiliensis, S. orientalis)* – metric tons of harvest in set
FRZ	Bullet and frigate tunas *(Auxis thazard, A.rochei)* – metric tons of harvest in set
PBF	Pacific bluefin *(Thunnus orientali)* – metric tons of harvest in set
SKJ	Skipjack *(Katsuwonus pelamis)* – metric tons of harvest in set
TUN	Unidentified tuna *(Thunnini sp.)* – metric tons of harvest in set

An important feature of the IATTC data is the fact that while the data contain the departure date and arrival date for the entire trip, the sets and harvests that are included are limited to activity within the EPO. Specifically excluded from these data are any information on sets and harvests that were made outside of the EPO (e.g. in the WCPO). Further, vessels that are authorized to harvest in both the WCPO and the EPO may do so during a single trip. In fact, it is perfectly acceptable for an EPO vessel to operate in the WCPO during a closure period in force within the EPO.

As part of a supplemental data request, the IATTC staff provided the NEI Team with one additional data field (*EPODays*) showing the number of days within each trip that the vessel was physically located (based on observer data) in the EPO waters.

The fact that a vessel may have fished in non-EPO waters during a trip means that for many of the trips within the IATTC data, harvests shown are most likely only a subset of total harvest during the trip. Of the 11,645 trips included in the IATTC data, 6,084 (52 percent) were trips in which the vessel was physically located in the EPO for every day of the trip, while during the remaining 5,561 trips (48 percent), there were one or more days in which the vessel was not physically located within the EPO.

If vessels that were not physically located in the EPO for the entirety of their trip made tuna harvests in the WCPO, then the estimates of revenues generated during the trip are likely to be lower than actual total revenues. Similarly, if trip-level cost estimates are applied to the entire trip, costs are likely to overstate the vessel's actual costs of fishing in the EPO. The NEI Team will therefore adjust trip-level costs to account for non-EPO trip days. This represents an improvement from EPO purse seine cost estimations made in previous studies.

Other Data Provided by the IATTC

In addition to the primary harvest data and data showing EPO and Non-EPO days for each trip, the IATTC has also provided additional data for use in this analysis.

Sample Data on Fish Sizes 2000–2016

The IATTC provided available data from plant inspectors showing sample data on individual fish sizes by category for bigeye (BET), skipjack (SKJ) and yellowfin (YFT) by set type for the years 2000–2016. Size categories included in these data are: Small (0 – 2.5 kg), Medium (2.5 kg – 15 kg), and Large (15 kg +). These data are sample data and percentages sampled relative to total harvest vary by year and set type. These data are used to generate estimates of volumes of small and large BET and YFT by year to address concerns of IATTC staff that increasing percentages of "juvenile tuna" in more recent years.

Vessel-by-Vessel Data on Closure Periods Taken and Force Majeure Exemptions (2013–2017)

These data report the specific closure periods taken by each vessel. Also included are data on exemptions to closure periods granted due to claim of *Force Majeure.*

History of Purse Seine Vessel Replacements 2000–2016

This data shows the number of new and used vessels that are replaced vessels existing on the IATTC register for the years 2003–2016. These data are summarized in detail in Section 4.1.1 beginning on page 61.

2.1.1 Summary Information from the IATTC Data

This section provides summary data tables and figures for the following areas of interest:

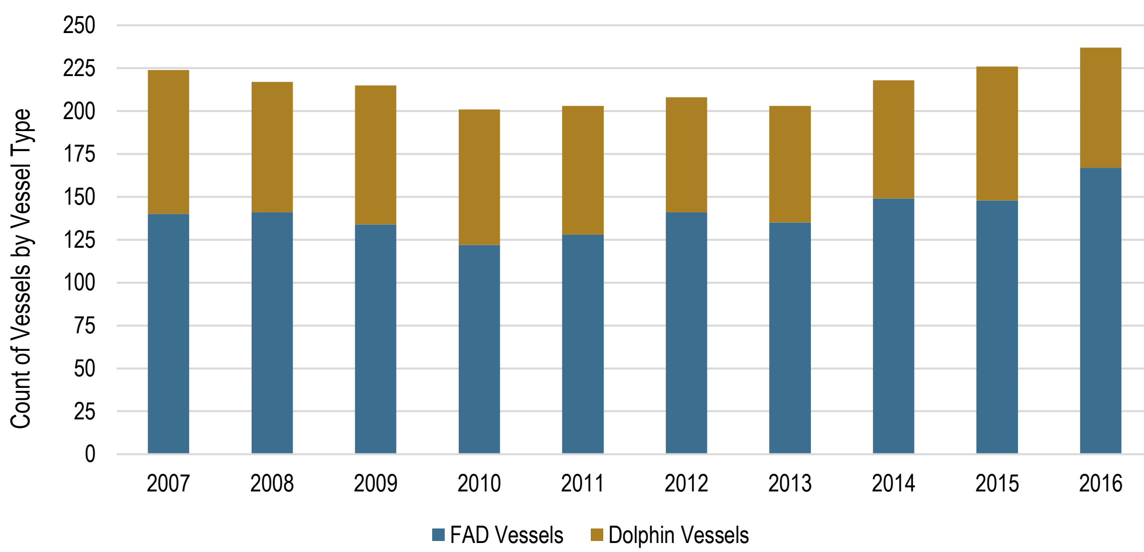
1) Number of vessels by vessel type and country type
2) Capacity of vessels that made landings in the EPO (Operational Capacity)
3) Number of vessels classified as FAD vessels and numbers classified as Dolphin vessels by flag (using the countries aggregations in #1).
4) Harvests by vessel type and species
5) Harvests by country type
6) Distribution of harvests by set type of location
7) Distributions of trip lengths by vessel type
8) Distribution of total annual DAS
9) Distributions of BTSD by vessel type
10) Percentages of Small (<15 kg) and Large (15 kg+) BET and YFT by set type
11) Total harvests by year of SKJ, small and large BET, small and large YFT by set type
12) Total harvests of small BET, large BET, small YFT, large YFT by year.

2.1.1.1 Participation Levels in the EPO Purse Seine Fishery

This section provides summary information on levels of participation by vessels in the EPO Purse Fishery by vessel type (Figure 4) and country type (Figure 5). The number of active vessels ranged from a high of 237 in 2016 to a low of 201 in 2010. Counts of FAD vessels range from a low of 122 to a high of 167, while dolphin vessels range from a high of 84 in 2007 to a low of 67 in 2012. Counts of FAD vessels have been generally increasing, while counts of Dolphin vessels have stabilized since 2012.

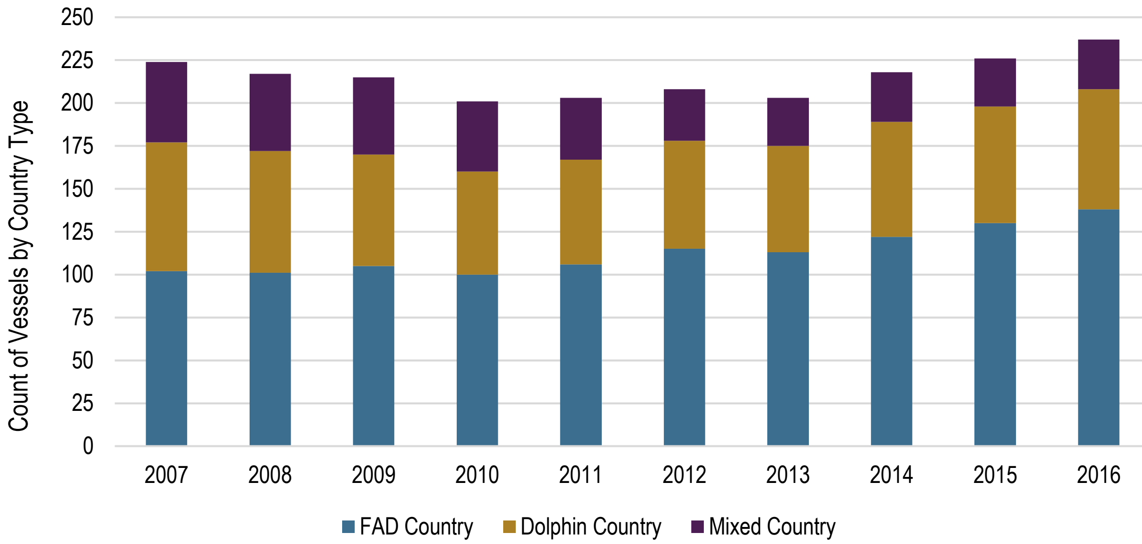
Figure 5 shows vessel counts by country type. Counts of vessels in FAD Countries (which include Ecuador, Peru, Panama, Spain, U.S. and others) have been generally increasing over time. Counts of vessels from Dolphin Countries (predominantly Mexico) have been relatively flat, while counts of vessels in Mixed Countries (generally Panama and two to three other countries) have been declining over time. We note two countries (Venezuela and Columbia) have moved back and forth between being classified as a Mixed country or a Dolphin Country.

Figure 4. Number of Participating Vessels by Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 5. Operative Capacity by Country Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Table 4 summarizes the number of purse seine vessels that had landings in the EPO and their capacity in terms of cubic meters (m^3) and metric tons of fish carrying capacity. Hereafter we will refer to the sum of m^3 of capacity of vessels that had landings in the EPO as the **Operative Capacity**. Both vessel counts and operative capacity were higher in 2016 than any year shown, and both have grown consistently since 2010. Since 2010, operative capacity has grown at an average compound growth rate of 3.2 percent, while vessel counts have increased 2.4 percent per year.

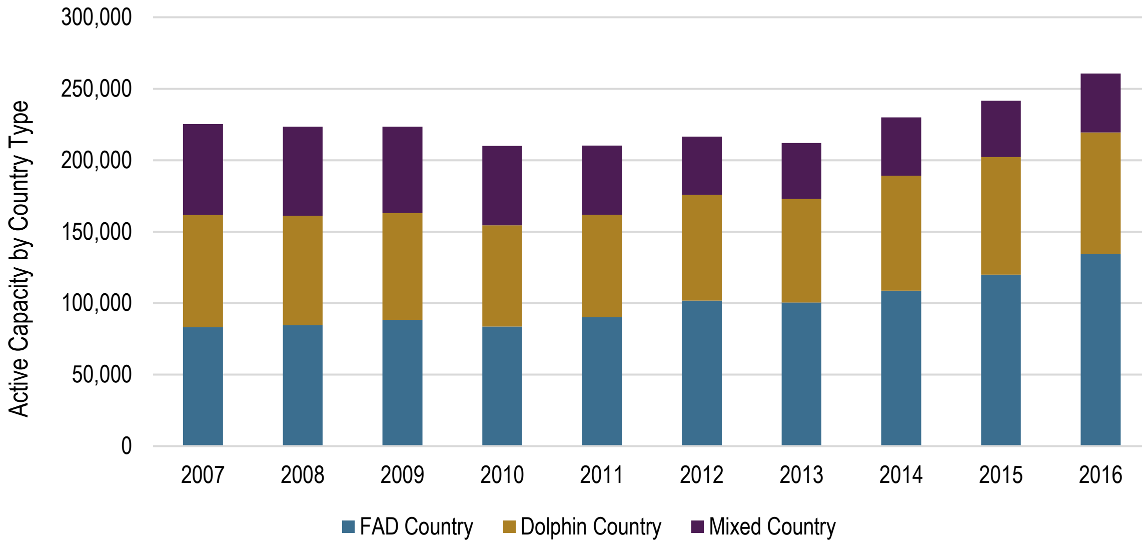
Table 4. Operative Purse Seine Vessels in the EPO and their Capacity

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Active Vessels	224	217	215	201	203	208	203	218	226	237
Total Operational Capacity (m^3)	225,105	223,394	223,616	209,904	210,943	216,585	212,009	230,191	241,634	261,496
Average Capacity (m^3) / vessel	1,005	1,029	1,040	1,044	1,039	1,041	1,044	1,056	1,069	1,103

Source: Developed by Northern Economics using IATTC data.

Figure 6 summarizes operative capacity in the EPO purse seine fleet by country type and year from 2007 through 2016. During the 10-year period, capacity was relatively stable for 3 years, then was lower but fairly stable from 2010 to 2013. Since 2013, total operative capacity has increased at a compound annual growth rate of 5.4 percent with the increase primarily in vessels from FAD Countries. As shown in Figure 2 on page 7, the capacity increases from 2014 to 2016 correspond to resolution of capacity claims of CPCs and activation of available capacity.

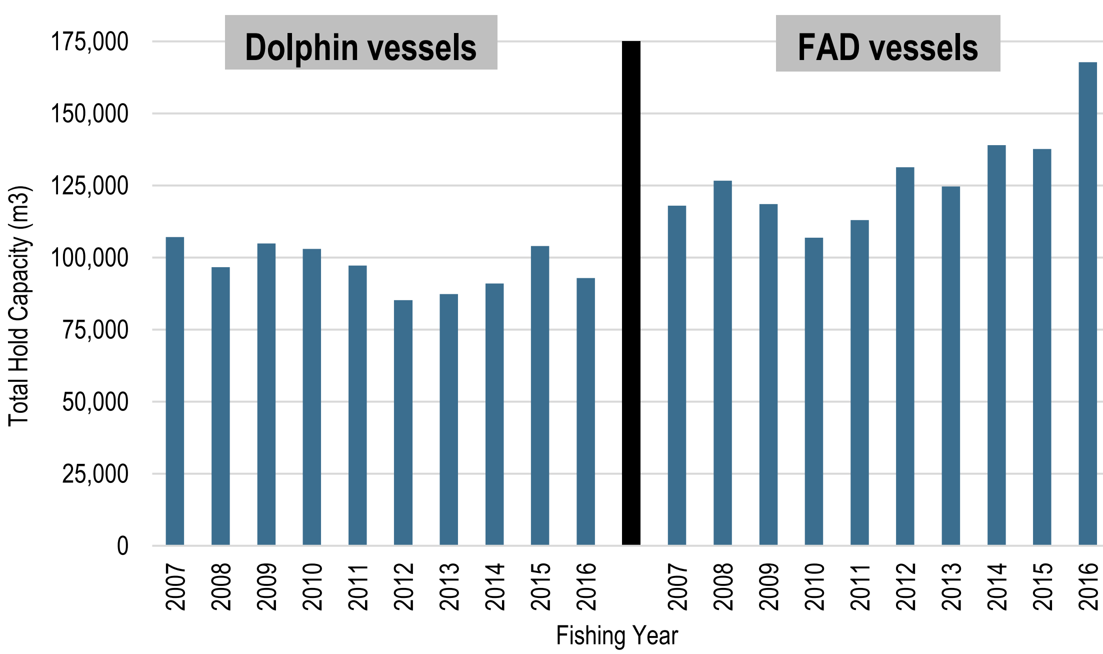
Figure 6. Operative Capacity by Country Type in the EPO by Year, 2007–2016



Source: Developed by Northern Economics using IATTC data.

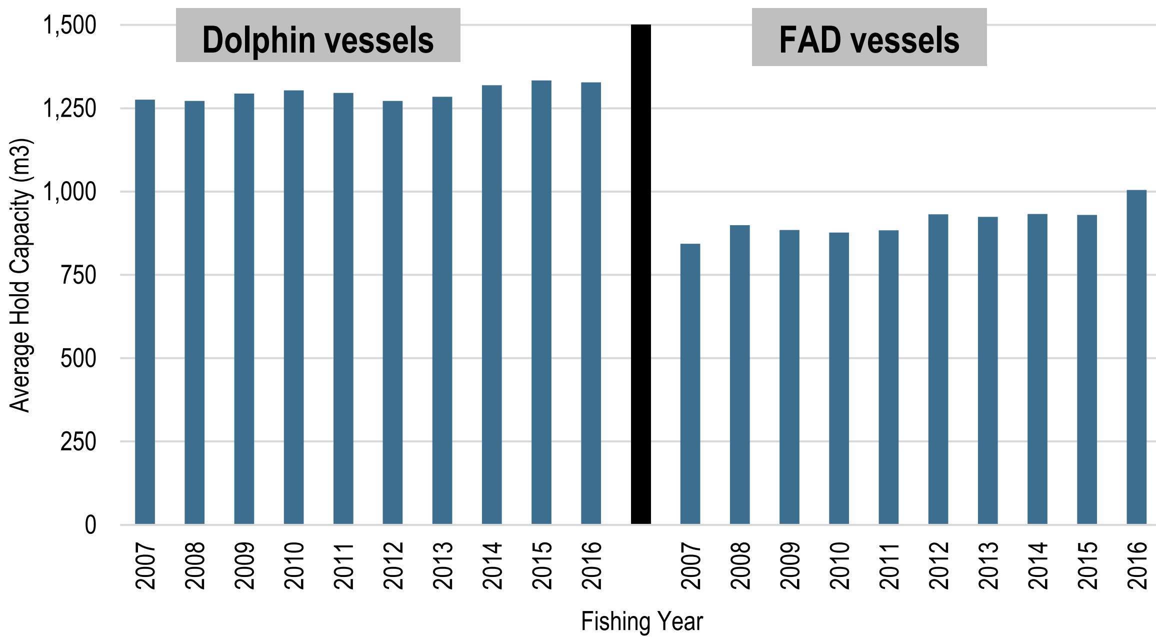
Figure 7 and Figure 8 summarize hold operative capacity in terms of Dolphin vessels and FAD vessels with Figure 7 showing the total capacity of each group by year from 2007 to 2016 and Figure 8 showing the average capacity per vessel over time. Total capacity of FAD vessels has clearly grown over time particularly since 2010, while total capacity of Dolphin vessels is generally less since 2012 than before. The average capacity of Dolphin vessels is much larger than the average capacity of FAD vessels. During the period shown, Dolphin vessels have had an average capacity of 1,298 m^3, while FAD vessels average 911 m^3.

Figure 7. Total Operative Capacity of Dolphin Vessels and FAD Vessels



Source: Developed by Northern Economics using IATTC data.

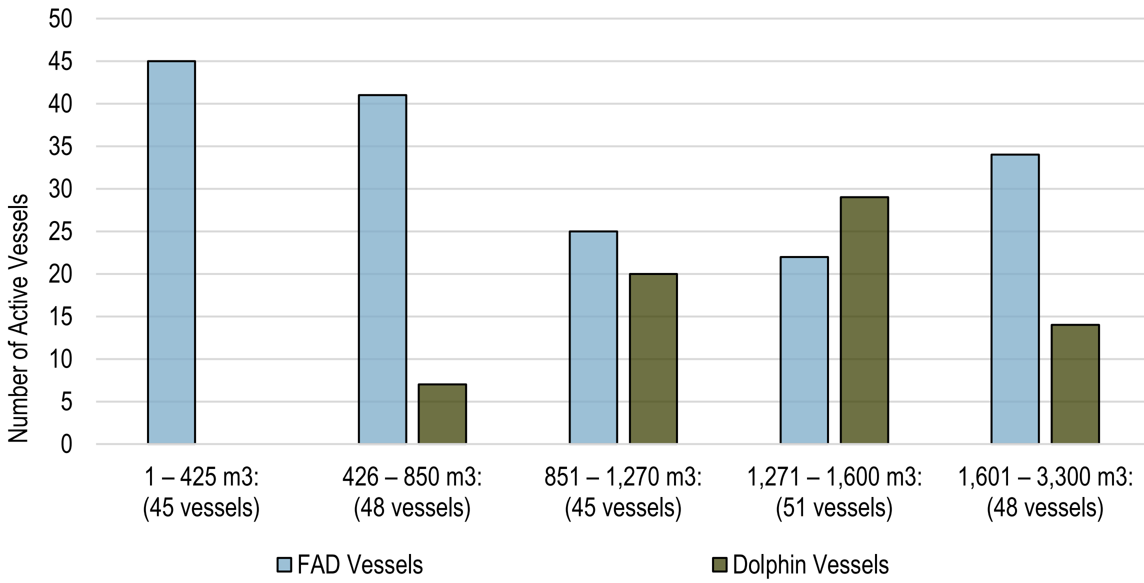
Figure 8. Average Operational Capacity of Dolphin and FAD Vessels



Source: Developed by Northern Economics using IATTC data.

As described earlier (see Table 2), the IATTC uses six vessel size classes (Class 1 – Class 6) based on capacity. The size classes are used for all vessels fishing for tunas in the EPO ranging from relatively small pole and line and longline vessels, to much larger purse seine vessels. The vast majority (≈ 79 percent) of purse seine vessels are classified as Class 6 vessels (426 m^3 or more), and thus the size classes are not that useful for examining the distribution of vessels size. Figure 9 shows the distribution of 237 Dolphin and FAD vessels that were active in 2016 using an alternative set of five size bins with each bin containing between 45 and 51 vessels. The bin containing vessels of 425 m^3 or less corresponds to IATTC Classes 1–5, while the remaining bins contain only Class 6 vessels. FAD vessels have a much wider variance in terms of capacity—the smallest active FAD vessel with 2016 was 125 m^3 while the largest was over 3,200 m^3. Dolphin vessels active in 2016 ranged from a low of 702 m^3 to a high of just over 2,200 m^3.

Figure 9. Distribution of Dolphin and FAD Vessels by Capacity Bins from 2016



Source: Developed by Northern Economics using IATTC data.

Inactive and Sunk Capacity

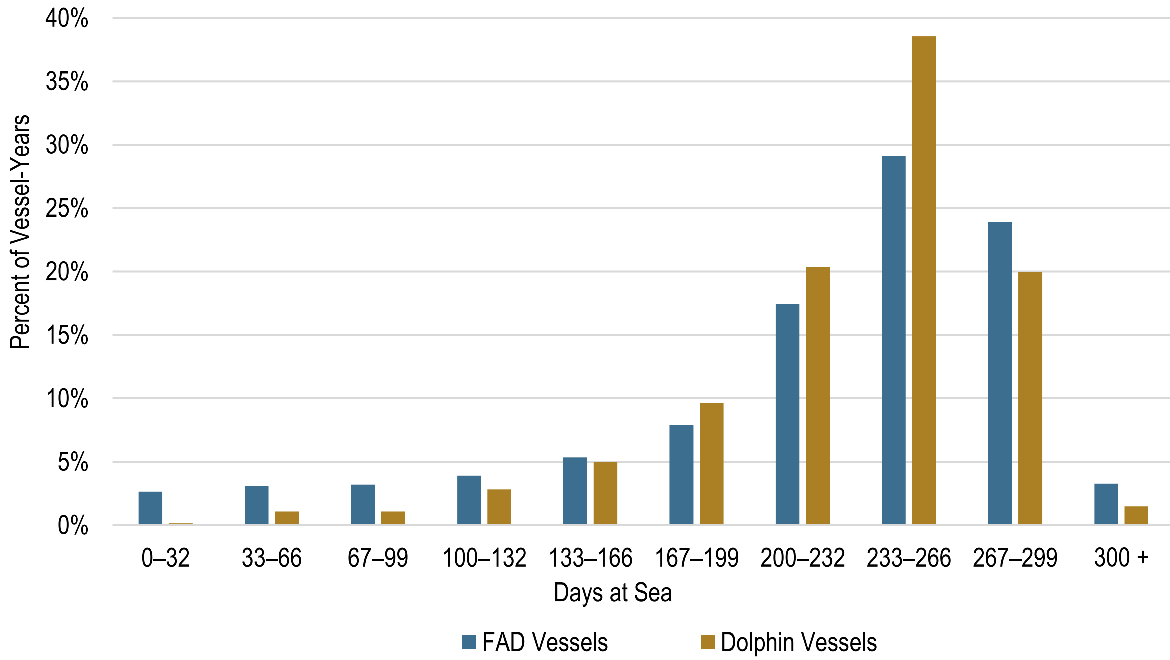
We note here that in additional to operational capacity the current IATTC Register includes 9 vessels that are listed as "Inactive" with a total of 4,211 m^3 of capacity, and another 4 "Sunk" vessels with 1,486 m^3 of capacity. As indicated in the IATTC Capacity Management discussion on page 6, this capacity can become operational if the country to which the capacity is assigned chooses to reassign the capacity to another vessel.

2.1.2 Indicators of Capacity Utilization

This subsection summarizes some key indicators of capacity utilization within the fleet of purse seine vessels. We summarize trip lengths in terms of DAS, and total in-year DAS. This section also documents and compares EPO and Non-EPO DAS of vessels and summarizes trip lengths and BTSD. All these factors contribute to conclusions regarding the utilization of purse seine vessels in the EPO and help determine the number of vessels directly affected by the closure periods that have been in effect since 2007.

Figure 10 and Table 5 summarize the distribution of annual DAS by active vessels from 2007 to 2016 by vessel type. For both vessels types, the peak of the distribution (the mode) is for annual DAS to be between 233 and 266 DAS per year—39 percent of Dolphin vessels fall within this bin, as do 29 percent of FAD vessels. We note, however, that 18 percent of FAD vessels and 10 percent of Dolphin vessels had 200 or fewer annual DAS. The NEI team made the assumption that vessels with fewer than 200 DAS are unlikely to be negatively impacted by the closure periods—vessels with 200 or fewer DAS that truly wish to take an additional trip should be able to find the time during the remaining 103 non-closure days to undertake the additional trip.

Figure 10. Distribution of Annual DAS by Vessel Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Table 5. Distribution of Annual DAS by Vessel Type, 2007–2016

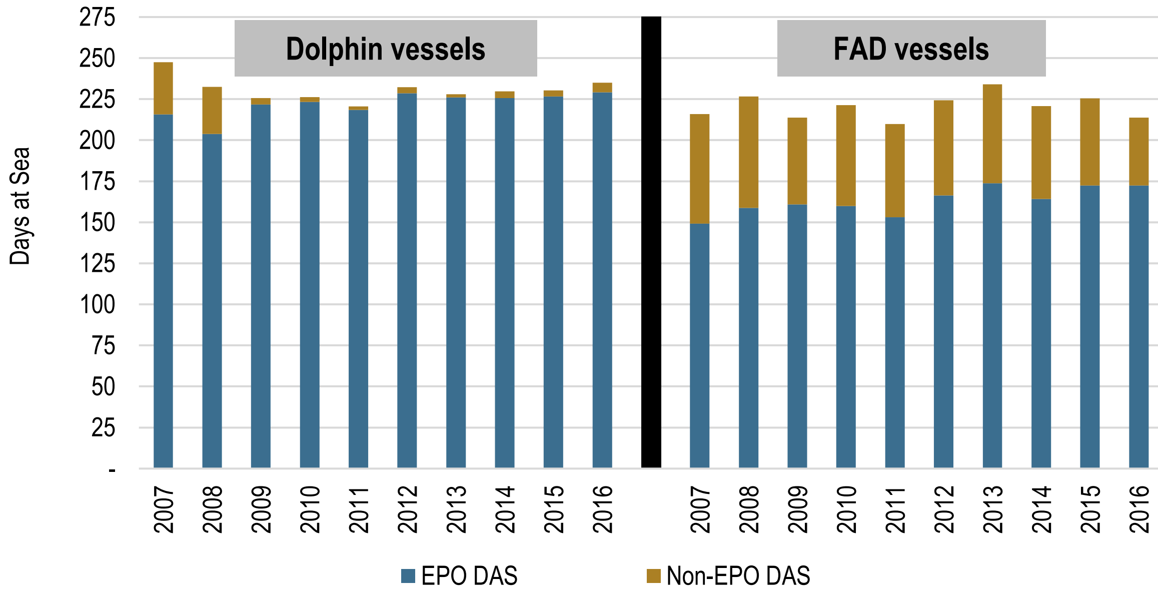
Vessel Type	0–32 DAS	33–66 DAS	67–99 DAS	100–132 DAS	133–166 DAS	167–199 DAS	200–232 DAS	233–266 DAS	267–299 DAS	300 + DAS
FAD vessels	3%	3%	3%	4%	5%	8%	17%	29%	24%	3%
Dolphin vessels	0%	1%	1%	3%	5%	10%	20%	39%	20%	1%

Source: Developed by Northern Economics using IATTC data.

As briefly mentioned in discussion of terms and definitions beginning on page 11, a vessel can fish in both the EPO and the WCPO during any given trip. Thus, total DAS may contain a mix of EPO DAS and non-EPO DAS. Figure 11 shows the average number of DAS per vessel by year with splits of EPO DAS and non-EPO DAS by vessel type. As shown in Figure 11, Dolphin vessels average more total DAS (231) than FAD vessels (221) and they have very few non-EPO DAS—since 2009, Dolphin vessels average just 4 non-EPO DAS. FAD vessels average 57 non-EPO DAS per year, or 26 percent of their Total DAS.

The number of non-EPO DAS used by FAD vessels is an indication that fishing in the WCPO is a viable option for many FAD vessels, while it doesn't appear to be an important factor for Dolphin vessels. The number of Non-EPO DAS used by FAD vessels is also an indicator of "latent" capacity—if FAD vessels chose to fish all their DAS in the EPO, they could, in theory, increase their EPO harvests by 26 percent—i.e., by the same percentage they could increase their EPO DAS as discussed above.

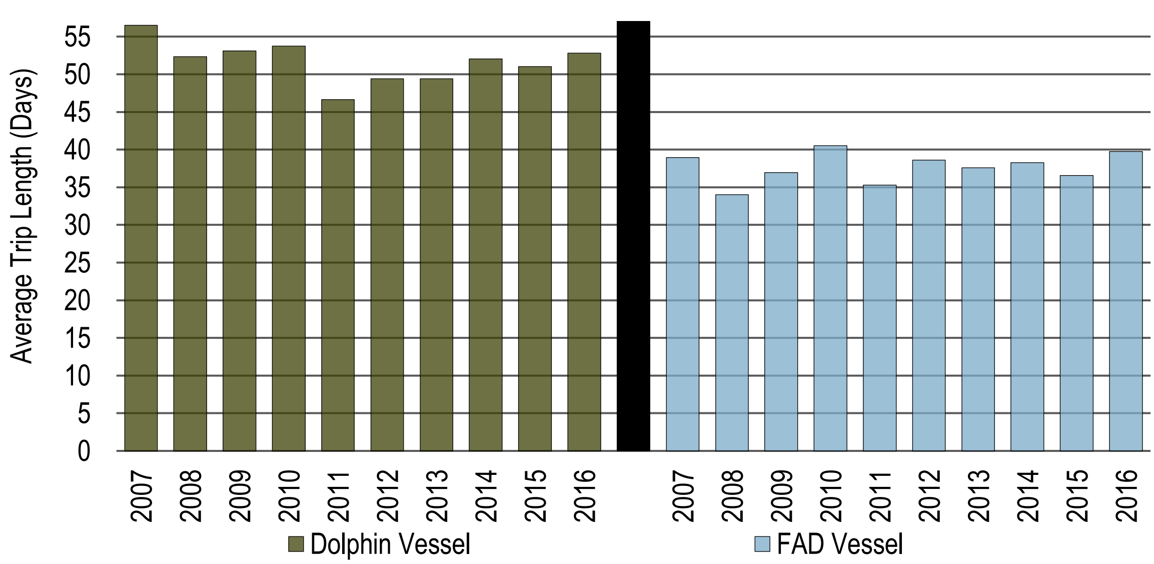
Figure 11. EPO and Non-EPO DAS by Vessel Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 12 shows the average trip lengths of Dolphin vessels and FAD vessels from 2007 to 2016. For Dolphin vessels, the peak trip lengths occurred in 2007 at 58, fell to between 52 and 54 from 2008 to 2010, then dropped to 47 days in 2011. Since 2012, average Dolphin vessels trip lengths have been increasing and in 2016 reached 53 days. Since 2012, trip lengths of FAD vessels have remained within a fairly narrow range—between 34 and 40 days. Dolphin vessels are generally larger than FAD vessels and (as will be shown in Figure 27 on page 29) sets on dolphin have lower rates of catch than sets on FADs; therefore, it is not surprising that trip lengths of Dolphin vessels are generally longer than for FAD vessels. A simple regression on average trip lengths by year does not indicate statistically significant trends, either up or down.

Figure 12. Average Trip Lengths of Dolphin and FAD Vessels, 2007–2016

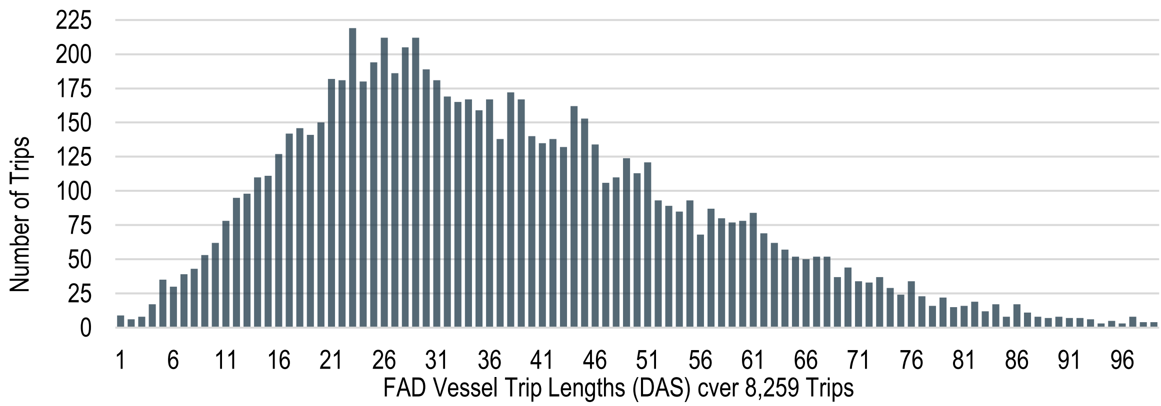


Source: Developed by Northern Economics using IATTC data.

Figure 13 and Figure 14 summarize the distributions of trip lengths in terms of DAS for all trips taken by FAD vessels (8,259 trips) and Dolphin vessels (3,267 trips) in the EPO purse seine fishery from 2007 through 2016—the figures exclude a total of 119 trips that were longer than 99 DAS. Total days at sea are calculated as the number of elapsed days between the departure date and the arrival date for a particular trip and assume that both the departure day and the arrival day count as a full DAS. It should be noted that the trip lengths summarized in this section are calculated without regard to whether the departure date and the arrival date occur in the same calendar year and without regard to DAS in which the vessel was not physically located in the EPO.

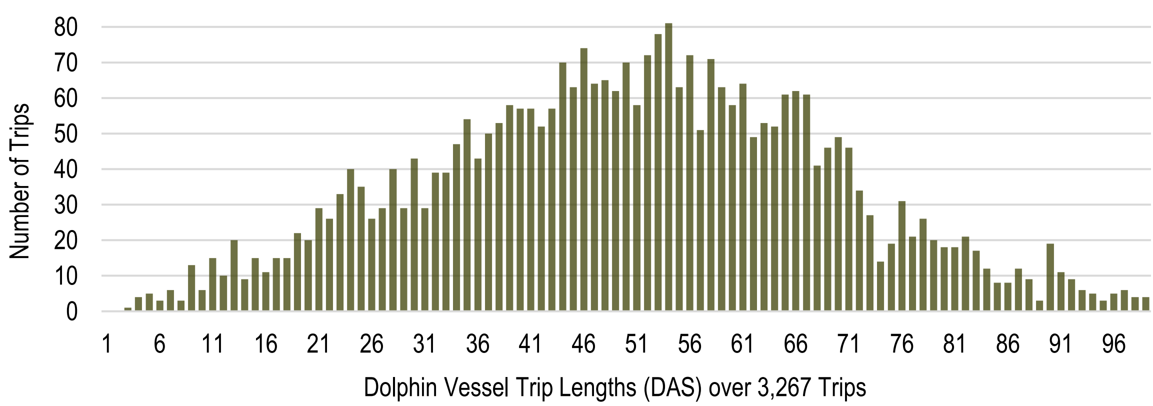
The statistical mode of trip lengths for FAD vessels is 23 DAS, while the statistical mode of trip lengths for Dolphin vessels is 54 days. The average FAD vessels trip length is 38 DAS, while the average Dolphin vessels trip length is 58 DAS. While it is certainly true that the average Dolphin vessels takes longer trips than the average FAD vessels, it is important to note that the average Dolphin vessel has greater hold capacity than the average FAD vessel. When trip lengths take capacity into consideration, as shown in Figure 15, then the differences between vessel types are much less apparent—FAD vessels and Dolphin vessels that have similar hold capacities tend to take trips of similar lengths. A regression analysis reveals that both capacity and whether the vessel is a Dolphin or FAD vessel are significant indicators of trip lengths. However, catch per EPO day is also a critical determinant of trip length—the better the fishing, the shorter the trip.

Figure 13. Distribution of Trip Lengths for FAD Vessels, 2007–2016



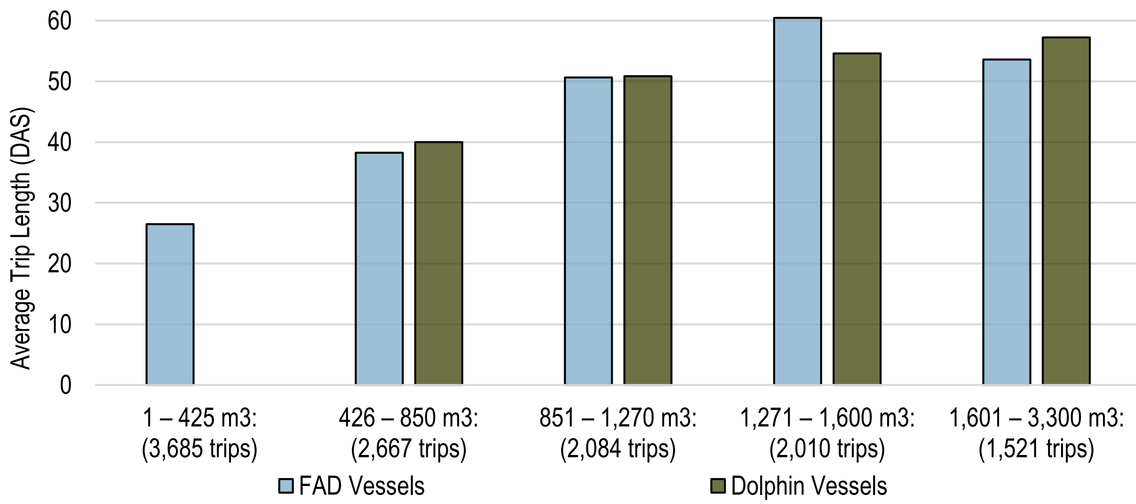
Source: Developed by Northern Economics using IATTC data.

Figure 14. Distribution of Trip Lengths for Dolphin Vessels, 2007–2016



Source: Developed by Northern Economics using IATTC data.

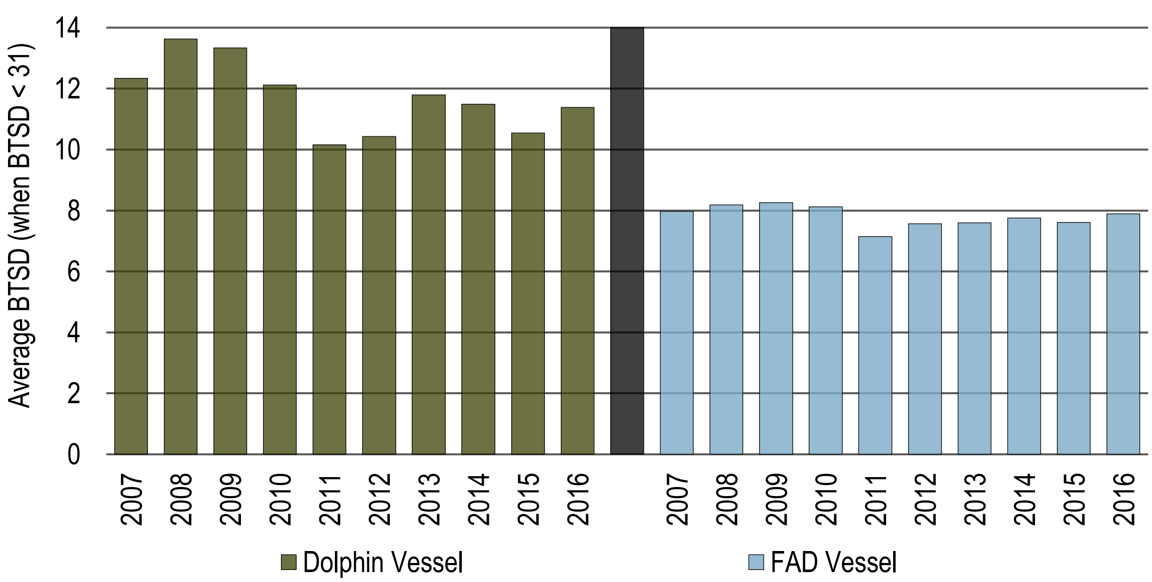
Figure 15. Trip Lengths of FAD and Dolphin Vessels by Capacity Group, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 16 summarizes average Between Trip Shore Days (BTSD) for Dolphin vessels and FAD vessels, when BTSD are less than 31 days in length. BTSD for Dolphin vessels have in general been trending downward with the exception of 2011 and 2012, when BTSD were at their lowest levels. Over the period shown, Dolphin vessels' BTSD have averaged 11.7 days. FAD vessels have averaged just 7.8 BTSD (when BTSD are less than 31 days). The reasons behind the shorter BTSD periods for FAD vessels have not been determined, particularly since the difference appears when Dolphin vessels and FAD vessels of similar capacities are compared (see Figure 19 on page 25). A simple linear regression on BTSD by year for Dolphin vessels indicates a statistically significant downward trend of 0.25 fewer BTSD per year. A similar regression on FAD vessels indicated no significant trend, either up or down.

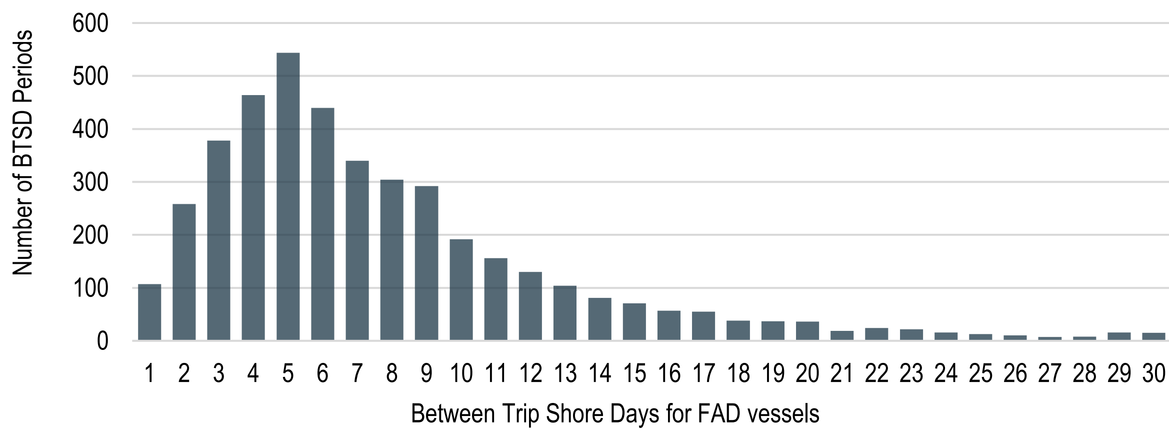
Figure 16. BTSD for Dolphin and FAD Vessels, when BTSD are less than 31 Days



Source: Developed by Northern Economics using IATTC data.

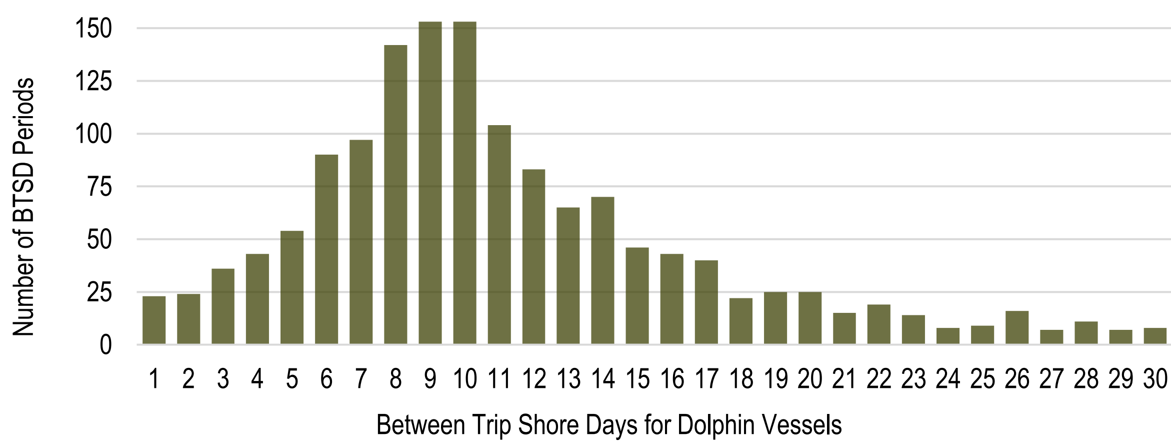
Distributions of BTSD for Dolphin vessels and FAD vessels appear have similar characteristics. The average Dolphin vessel takes more BTSD than the average FAD vessel, but Dolphin vessels are also bigger on average than FAD vessels. Figure 17 and Figure 18 (shown on page 24) depict the distribution of BTSD for FAD vessels and Dolphin vessels when BTSD are 30 days or less. Figure 19 shows average BTSD of FAD vessels and Dolphin vessels by capacity group, and this figure indicates that Dolphin vessels have had longer BTSD than FAD vessels across the four capacity groups into which both Dolphin vessels and FAD vessels fall. A regression analysis indicates that vessel type is a very significant indicator of BTSD, along with the DAS and total catch of the associated trip, while capacity is less important.

Figure 17. Distribution of BTSD for FAD Vessels, 2007–2016



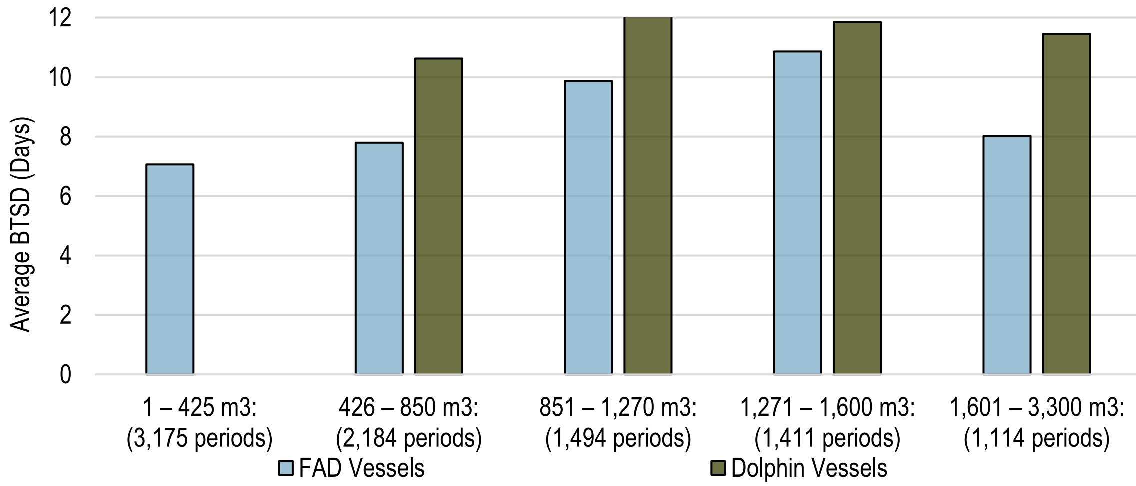
Source: Developed by Northern Economics using IATTC data.

Figure 18. Distribution of BTSD for Dolphin Vessels, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 19. BTSD of FAD and Dolphin Vessels by Capacity Group, 2007–2016

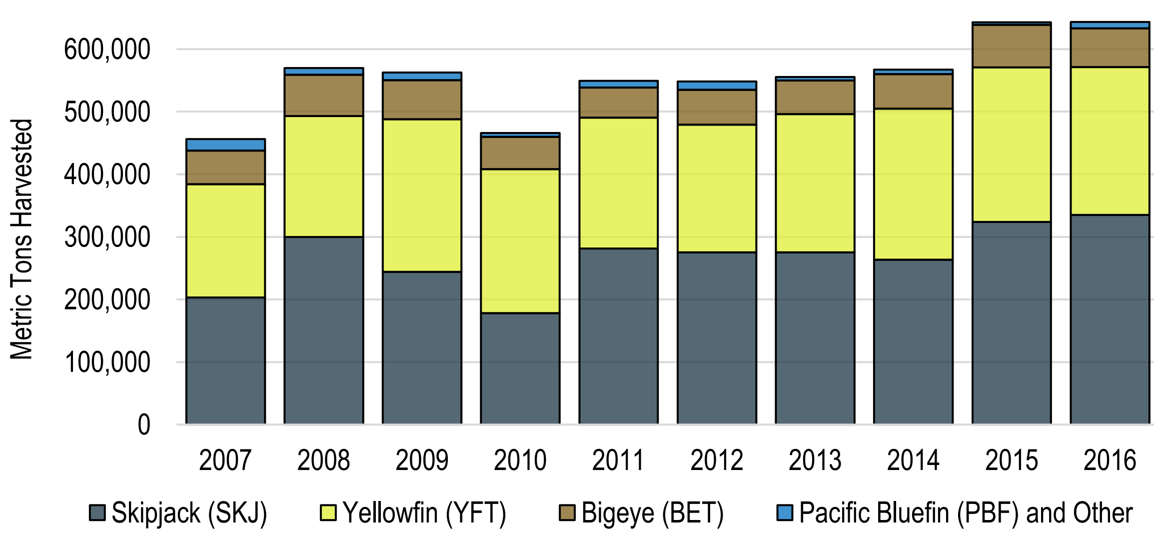


Source: Developed by Northern Economics using IATTC data.

2.1.2.1 Harvest and Effort Data from the EPO Purse Seine Fishery

This subsection of the data summary focuses on harvests and effort (sets). Figure 20 shows total harvests in the EPO purse seine fishery by species. Total harvest increased by approximately 87,000 mt in 2015 and 2016 from harvests seen from 2011 to 2014. In general, the average percentage split between the three primary species has not shown any particular trend: SKJ averages approximately 49 percent of the total, while YFT and BET average 39 percent and 10 percent respectively. Overall harvest has grown from 2007 to 2016 by a compound average growth rate of 3.5 per year. Total harvests have increased from 460,000 mt in 2007 to 646,000 mt in 2016.

Figure 20. Landings by Species in the EPO Purse Seine Tuna Fishery, 2007–2016



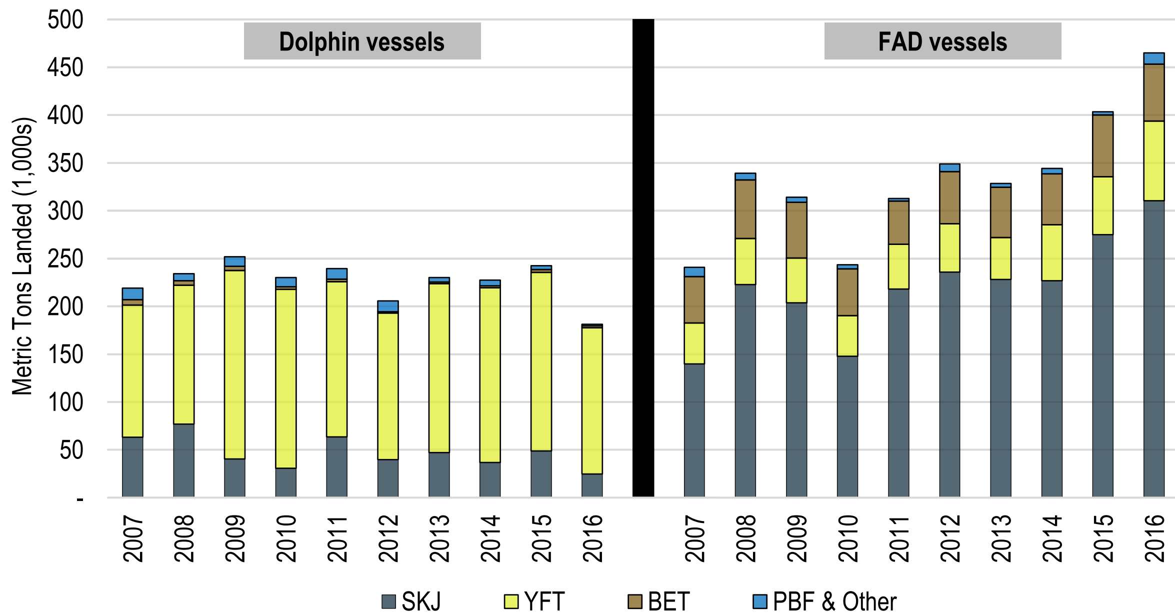
Source: Developed by Northern Economics using IATTC data.

Figure 20 also indicates a relatively small amount of harvests of other tuna species. These include Pacific bluefin (PBF), bonitos, black skipjack, albacore and other tuna species. There is in a small number of relatively small vessels that target PBF for live delivery to net-pen farms in Mexico. The IATTC set an annual harvest limit on PBF of 3,300 mt for EPO purse seine vessels beginning in 2015.[7]

Figure 21 compares EPO tuna harvests of Dolphin vessels to harvests of FAD vessels over the 10-year period. Total harvests of Dolphin vessels had been relatively stable through 2015, ranging between 200,000 mt and 250,000 mt, but experienced a significant decline in 2016 (primarily due to a decline in catch per set—see Figure 27 on page 29). Total harvests of FAD vessels have steadily increased over the same period from 241,000 mt in 2007 to 465,000 mt in 2016—this represents an annual growth rate of 6.7 percent. For FAD vessels the annual growth of SKJ has averaged 8.3 percent, while the annual average growth of YTF and BET was 6.8 percent and 2.5 percent respectively. FAD vessel harvest increases are strongly correlated with overall increases in numbers of sets (see Figure 29 on page 31).

Figure 21 also demonstrates the difference in species mix between the two vessel types. YFT accounts for an average of 74 percent of the Dolphin vessel total with SKJ at 20 percent and BET at only 1 percent. For FAD vessels, SKJ accounts for 66 percent of the total while YFT and BET account for 16 and 16 percent respectively.

Figure 21. EPO Purse Seine Tuna Landings by Species and Vessel Type, 2007–2016



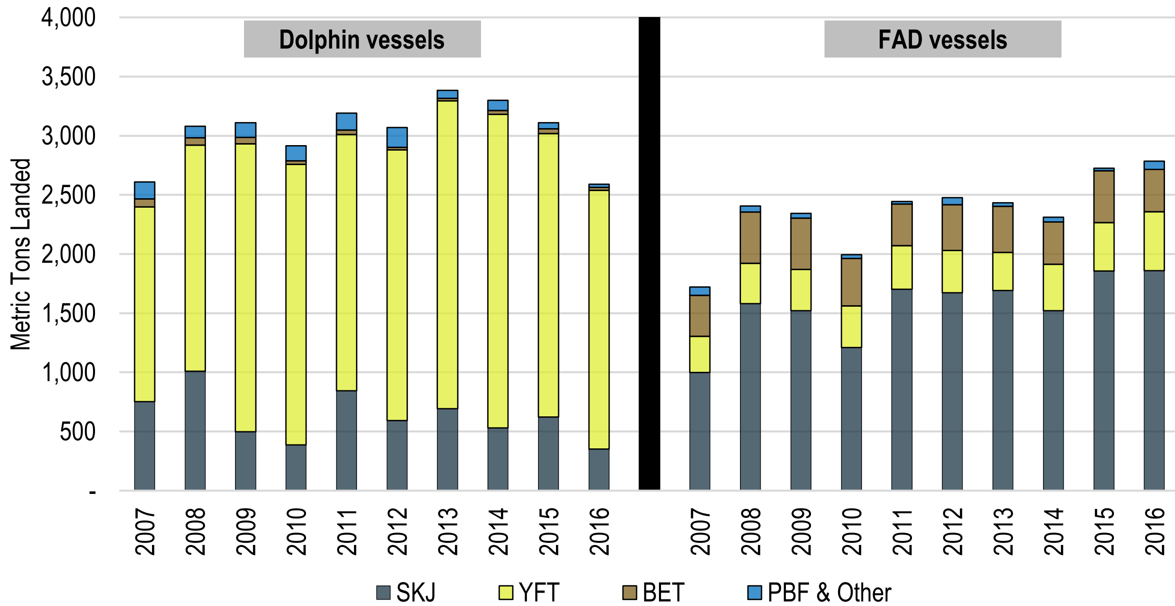
Source: Developed by Northern Economics using IATTC data.

Figure 22 shows the average landings per vessel by Dolphin vessels and FAD vessels. While Dolphin vessel landings per vessel vary, the general trend is relatively flat. Note also that Dolphin vessels landings in 2016 were the lowest during the period shown and total landings per vessel has declined each year since the high in 2013. Landings per vessel by FAD vessels show an increasing trend over time—since 2007 total landings per FAD vessel have increased at an annual rate of 5 percent, with SKJ mt/vessel and YFT mt/vessel

[7] See IATTC Resolution C-14-06 at https://www.iattc.org/PDFFiles/Resolutions/_English/C-14-06-Conservation-of-bluefin-2015-2016.pdf

increasing at 6.4 percent and 5.0 percent respectively, while BET mt/vessel was relatively flat, increasing by just 0.4 percent per year. Landings in 2016 for FAD vessels were the highest for the period shown.

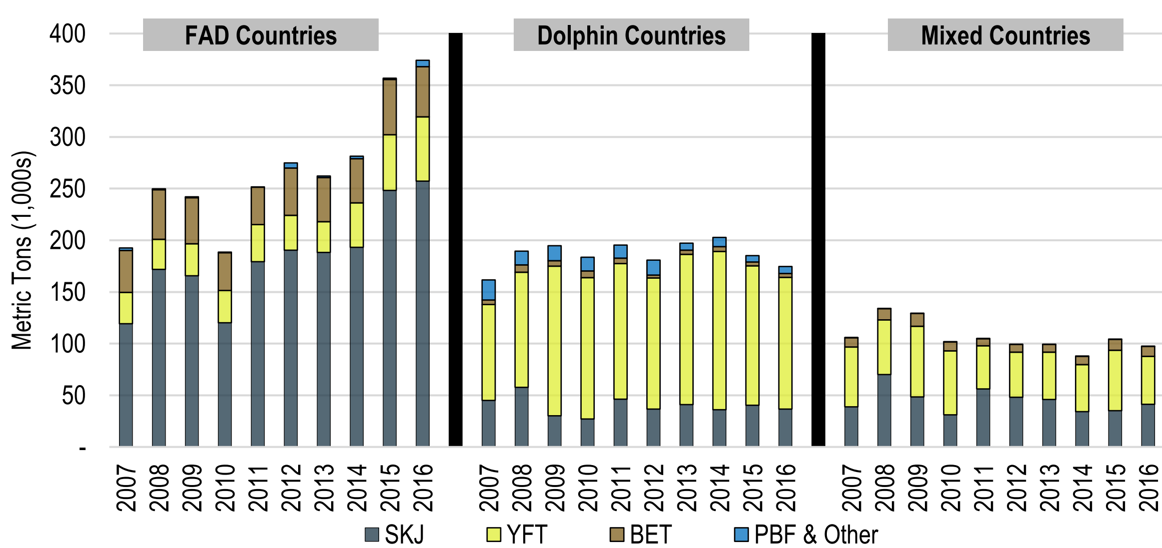
Figure 22. Average Landings per Vessel by Vessel Type and Species, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 23 summarizes landing by country type. Not surprisingly, FAD countries and Dolphin countries have similar composition and volumetric trends as FAD vessels and Dolphin vessels respectively. By definition, Mixed countries are a hybrid of the two types of vessels. Accordingly, Mixed country total harvests include a greater percentage of SKJ than Dolphin countries' harvests, and a greater percentage of YFT than FAD countries. Overall, harvests in Mixed countries have been flat since 2010.

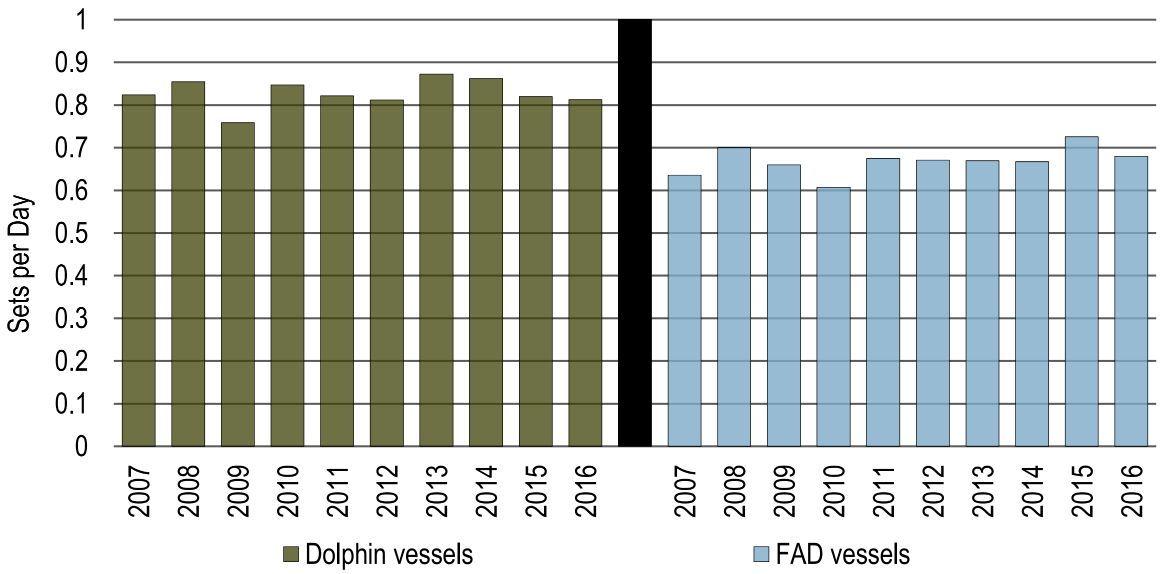
Figure 23. Total EPO Purse Seine Harvest by Flag, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 24 summarizes the number of sets per day by Dolphin vessels and FAD vessels from 2007 to 2016. Dolphin vessels average 0.83 sets per day while FAD vessels average 0.67 sets per day. Simple linear regressions on sets per day by year yield coefficients that are not significantly different from zero, indicating that sets per day are not increasing over the period shown from a statistical perspective.

Figure 24. Sets per Day by Vessel Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

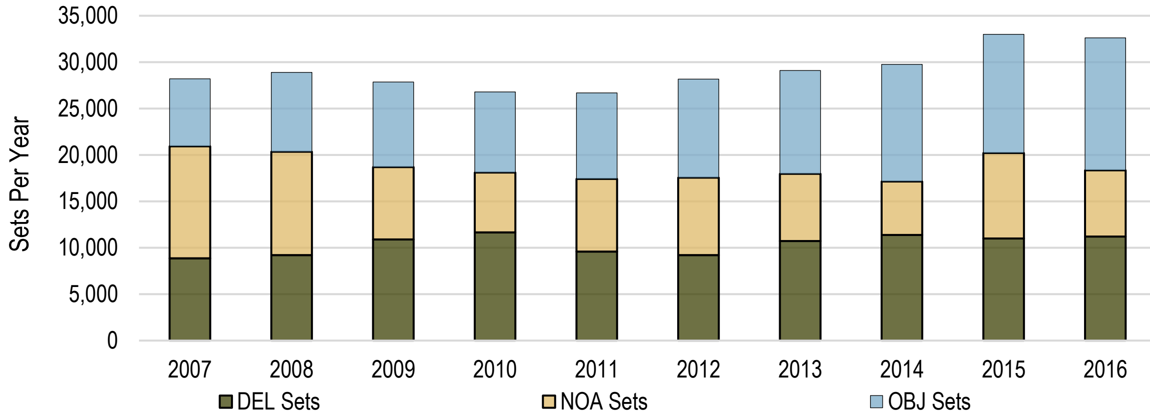
Figure 25 through Figure 27 on the following pages summarize effort and landings by the three set types dolphin sets (DEL sets) FAD/floating object sets (OBJ sets), and unassociated sets (NOA sets). Figure 25 documents the total number of sets per year by set type. Since 2007, the total number of sets in the EPO purse seine fishery has increased at annual average growth rate of 1.5 percent per year. The largest component of growth has been in the number of OBJ sets, which have increased at an annual rate of 7.0 percent. DEL sets have also increased, but at a lower annual rate of 2.4 percent. Numbers of NOA sets have been more volatile, but over the entire period have declined by 5.8 percent per year.

The NEI Team notes that the IATTC does not have official definitions for set types—the set type for any given set is determined by the vessel operator. Observers also enter a set type in their records based on definitional guidance provided by the AIDCP. Because of the lack of formal definitions, set type determination can be somewhat ambiguous. This is particularly true of NOA Sets. Assume for example that a purse seine is deployed 200 meters away from a floating object, and the seine is never closer than 200 meters from the object. Whether this a NOA set or an OBJ set is left up to the discretion of the vessel operator. Development of “official” definitions of set types is assessed briefly in Section 0.

Figure 26 shows total harvest by set type. Almost all of the increase in harvests can be attributed to OBJ sets, although landings from DEL sets grew very quickly from 2007 to a high in 2009. Total Landings in OBJ sets have increased by over 6 percent per year since 2007.

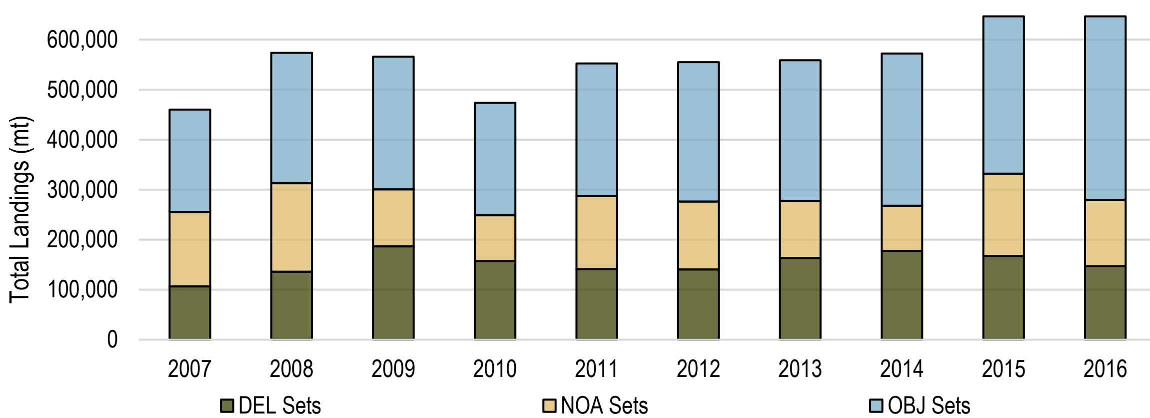
Figure 27 shows landings/set by set type. Landings/set from OBJ sets appear to have stabilized the last few years after declining from 2008 to 2014. Landings from NOA sets have generally been increasing over the period. Landings/set from DEL sets were relatively flat from 2011 to 2015, but in 2016 dropped to their lowest levels since 2007. The large drop in catch per DEL set is seen as the primary cause of the large drop in Dolphin vessel harvests in 2016 (see Figure 21.)

Figure 25. Total Effort by Set Type in the EPO Purse Seine Fishery, 2007–2016



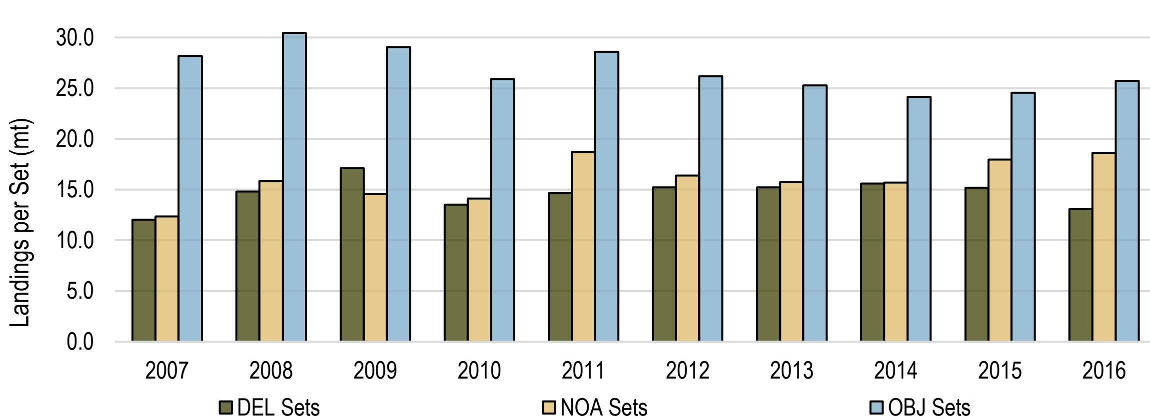
Source: Developed by Northern Economics using IATTC data.

Figure 26. Total Landings by Set Type in the EPO Purse Seine Fishery, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 27. Landings Per Set by Set Type in the EPO Purse Seine Fishery, 2007–2016

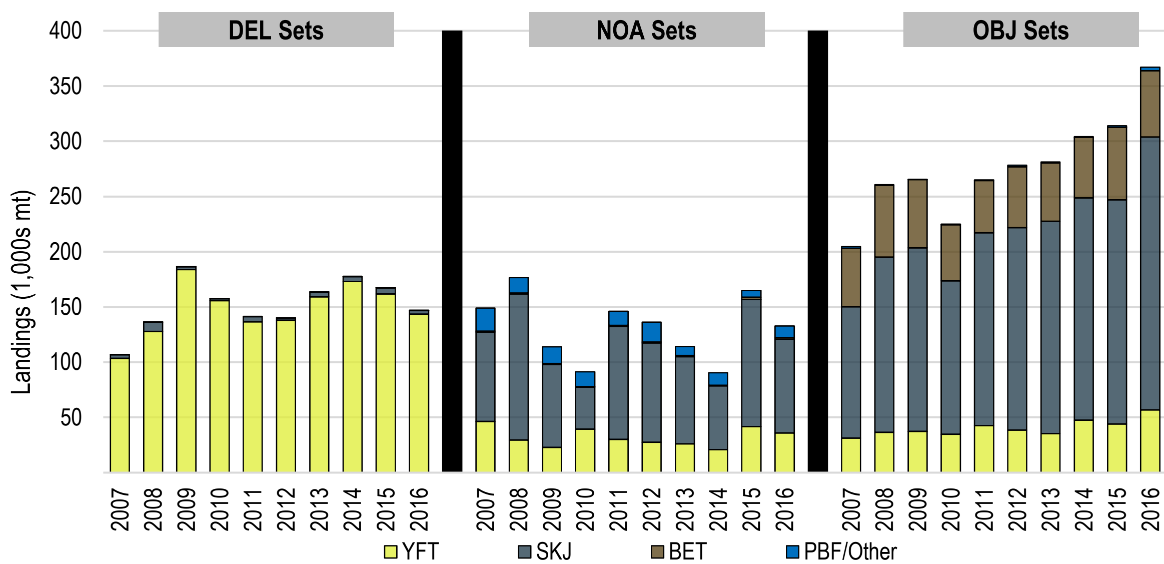


Source: Developed by Northern Economics using IATTC data.

Figure 28 shows landings by species for each set type. DEL sets very clearly focus on YFT—since 2007, 97.3 percent of all tuna landed from DEL sets were YFT, with SKJ comprising all but 0.1 percent of the remainder. Since 2007, DEL sets have accounted for only 22 mt of BET and only 185 mt of other tuna. Landings from OBJ sets are predominantly SKJ (64.5 percent) with BET (20.5 percent) and YFT (14.6 percent) comprising the remainder. NOA set catch primarily SKJ (65.0 percent) followed by YFT (24.4 percent), but very few BET (0.8 percent). NOA sets account for 92 percent of the PBF and other tuna species taken in the EPO.

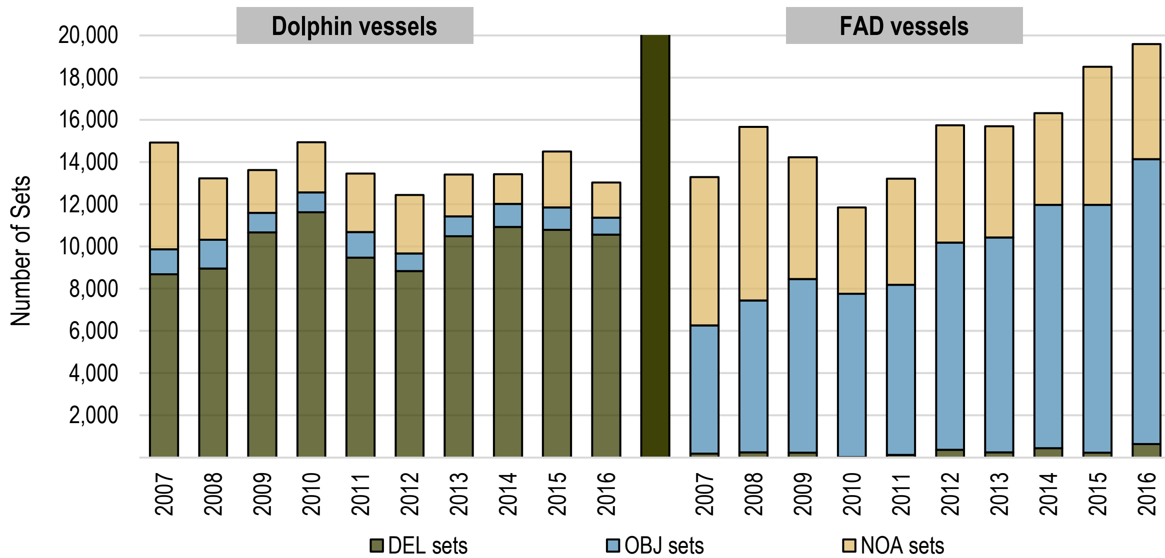
Figure 29 documents that all three set types are utilized by both vessel types, although DEL sets by FAD vessels account for only two percent of their total. Seventy-four percent of Dolphin vessel efforts are DEL sets, while FAD vessels split their effort between OBJ sets (61 percent) and NOA sets (35 percent).

Figure 28. Landings by Set Type and Species, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 29. Set Types Utilized by Vessel Type, 2007–2016



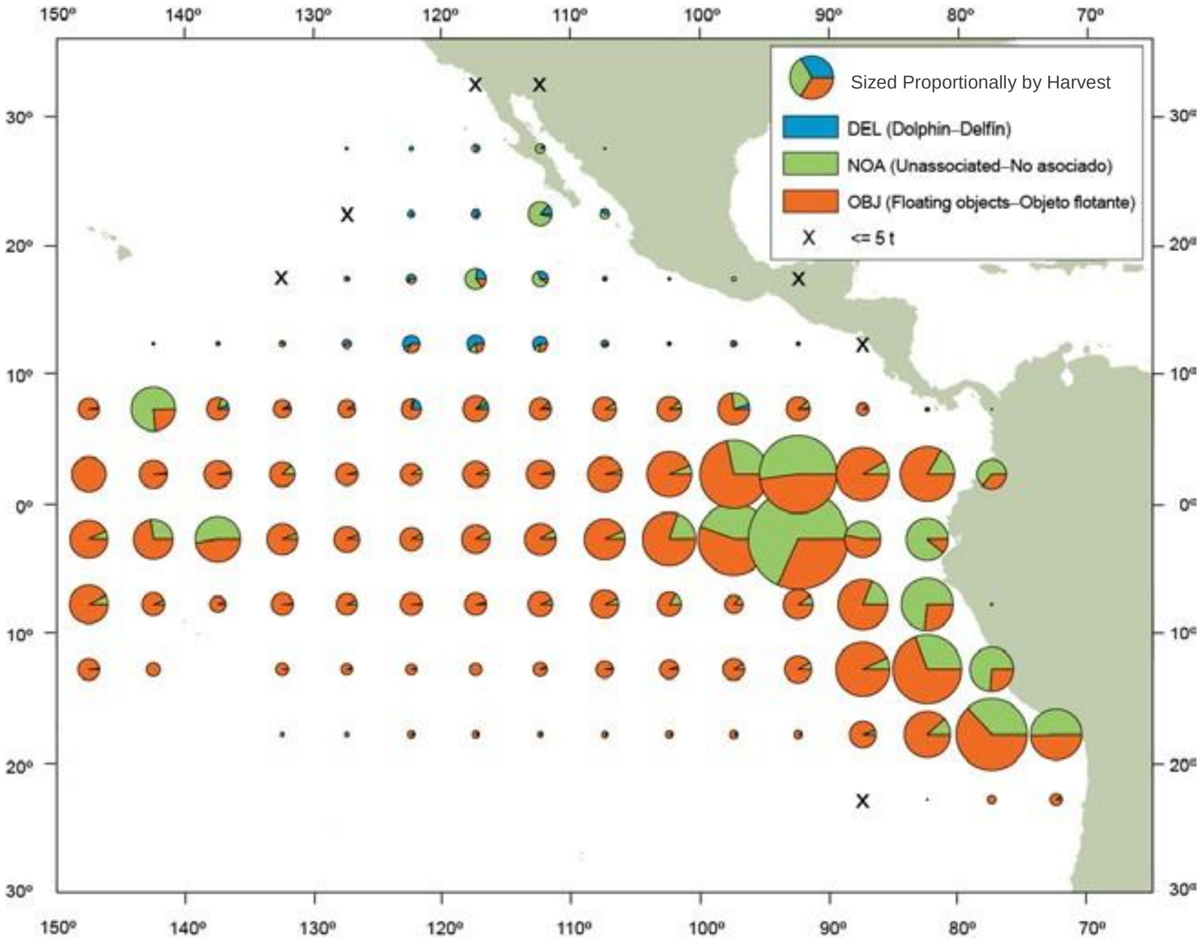
Source: Developed by Northern Economics using IATTC data.

2.1.2.2 Harvests of Skipjack Yellowfin, and Bigeye Tuna by Location and Set Type

This section provides a high-level overview of catch of the three primary species by location and type of set in the EPO purse seine fishery. The three figures on the following pages are reproduced from the IATTC Fishery Status Report—Tunas, Billfishes and Other Pelagic Species in the Eastern Pacific Ocean in 2016.[8] Figure 30 shows catches of SKJ; Figure 31 shows catches of YFT; and Figure 32 shows catches of BET. In all the figures, harvests are shown in 5° × 5° bins, which at the equator comprise an area of 300 nautical miles × 300 nautical miles. The size of circle in each bin is proportional to harvests in all other bins over all three of the figures. For example, in Figure 30, the 5° × 5° bin with the largest harvest (92.5° W and 2.5°S) represents ≈135,000 mt of SKJ, and is approximately twice the area of the circle in 97.5° W and 2.5°S with SKJ catch of ≈ 62,700 mt. The latter bin is just slightly larger in size to YFT harvests at 87.5° W and 7.5°N in Figure 31 with harvests ≈ 60,000 mt.

[8] https://www.iattc.org/PDFFiles/FisheryStatusReports/_English/FisheryStatusReport15.pdf

Figure 30. Skipjack Catch by Set Type, 2011–2015 in 5° × 5° blocks

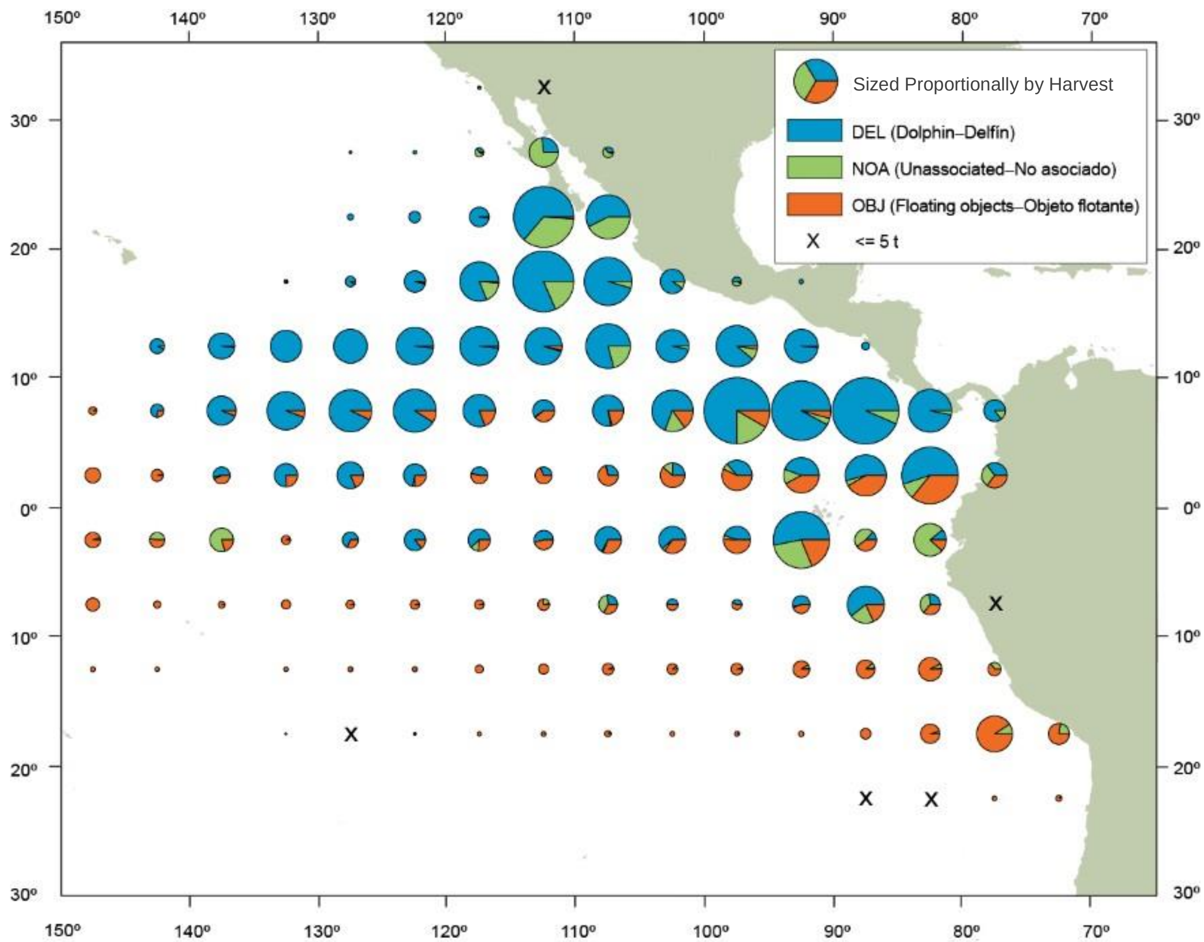


Notes: Circle sizes are proportionally across each 5° × 5° block. In this figure the largest circle centered at 92.5° W and 2.5°S represents ≈135,000 mt of SKJ. Circles of the same size in Figure 30–Figure 32 represent approximately the same amount of catch.

Source: Figure copied from IATTC Fishery Status Report—Tunas, Billfishes and Other Pelagic Species in the Eastern Pacific Ocean in 2016 (https://www.iattc.org/PDFFiles/FisheryStatusReports/_English/FisheryStatusReport15.pdf).

Comparing Figure 30 and Figure 31 reveals important differences in fishery patterns. The largest harvests of SKJ are taken from 10° N to 20°S, while the largest YFT harvests are primarily north of the equator up to 20° N. For SKJ, OBJ and NOA sets are predominate, with the largest harvests in NOA sets much more likely near shore or near island groups—particularly the Galapagos Islands on either side of the equator at 92.5° S, and the Marquesas Islands in the far west. OBJ sets for skipjack are more like to be the primary set type in 5° × 5° bins that are more distant from land. For YFT, harvests in DEL sets are clearly dominant unless effort is South of 10 °S, or out in the far west of the EPO.

Figure 31. Yellowfin Catch by Set Type, 2011–2015 in 5° × 5° blocks

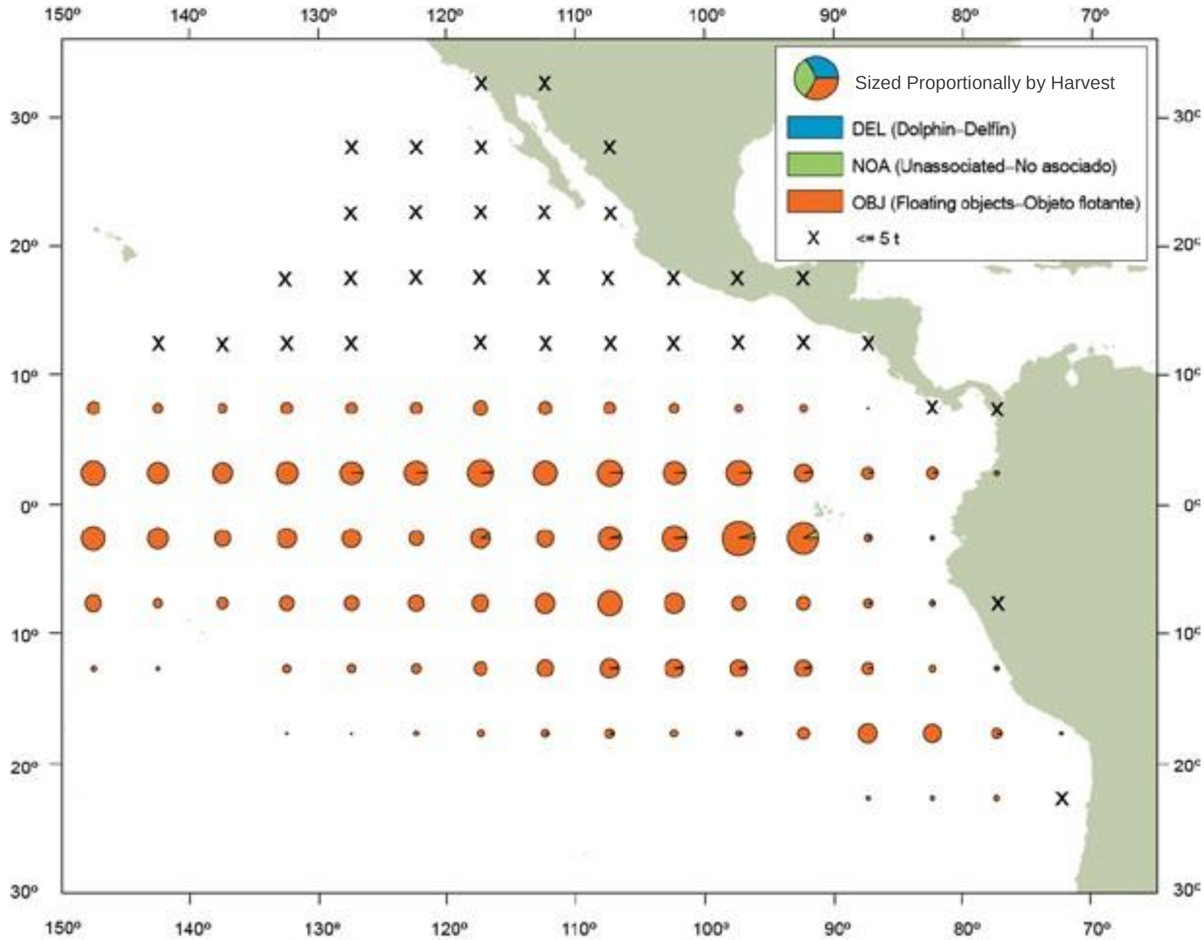


Notes: Circle sizes are proportional to catch of SKJ by each 5° × 5° block as shown in Figure 30. In this figure, the largest circle center at 87.5° W and 7.5°N represents ≈60,000 mt of YFT. Circles of the same size in Figure 30–Figure 32 represent approximately the same amount of catch.

Source: Figure copied from IATTC Fishery Status Report—Tunas, Billfishes and Other Pelagic Species in the Eastern Pacific Ocean in 2016 (https://www.iattc.org/PDFFiles/FisheryStatusReports/_English/FisheryStatusReport15.pdf).

OBJ Sets account for the vast majority of BET taken, with the largest harvests taken on either side of the equator (Figure 32). It also appears that BET harvests in OBJ sets are not highly correlated with proximity to land masses or island groups.

Figure 32. Bigeye Catch by Set Type, 2011–2015 in 5° × 5° blocks



Notes: Circle sizes are proportional to catch in each 5° × 5° block as shown in Figure 30. The largest circle centered at 97.5 ° W and 2.5°S represents ≈15,000 mt of BET. Circles of the same size in Figure 30–Figure 32 represent approximately the same amount of catch.

Source: Figure copied from IATTC Fishery Status Report—Tunas, Billfishes and Other Pelagic Species in the Eastern Pacific Ocean in 2016 (https://www.iattc.org/PDFFiles/FisheryStatusReports/_English/FisheryStatusReport15.pdf).

2.1.2.3 Harvests of Large and Small Bigeye and Yellowfin Tuna

Information provided by IATTC staff during the Advisory Committee Meeting indicates the importance of understanding harvests of BET and YFT by size. IATTC staff have stated that one of their major concerns with the excess levels of capacity is the fact that increasing amounts of smaller/sexually immature BET and YFT are being harvested, putting a strain on the long-term sustainable yield of two of the three primary species in the fishery. During the Advisory Committee Meeting in October, potential ways to reduce harvests of these sub-adult tunas were discussed.

Two important issues regarding sizes of BET and YFT were discussed: 1) the difficulty of discriminating between individuals of the two species when the specimens are small, and 2) stock consequences of harvesting large number of either species before they reach sexual maturity. Pedrosa-Gerasimio (2017)[9]

[9] at https://www.ncbi.nlm.nih.gov/pmc/articles/pmc3334917/

reports that discriminating between the two species at lengths less than 40 cm is very difficult and mis-identification may be as high as 30 percent. Regarding sexual maturity, Zhu (2011 at http://www.trjfas.org/uploads/pdf_675.pdf) reports that on average 50 percent of female BET in the Eastern Pacific have reached sexual maturity at 117.5 cm, while Itano (2001[10]) reports that 50 percent of female YFT in the Pacific reach sexual maturity at 104.6 cm. Based on these reports, BET and YFT are unlikely to be sexually mature until they are 15 kg or greater.

Following the Advisory Committee meeting, the NEI Team requested and obtained port-inspector Marine Fauna Report (MFR) sample data showing the tuna catch by size for each set type for 2000–2017. These data are summarized in Table 6. BET are primarily taken in OBJ sets and only *de minimis* amounts are taken in DEL sets. The percentage portions in the table show that while the majority of BET taken in OBJ sets are < 15 kg (very small or medium/small), just over 57 percent of the BET taken in NOA sets are large (15 kg +). The story is very different for YFT—in OBJ sets, 72 percent are very small or medium/small and 28 percent are large. In NOA sets the size split of YFT is fairly even—48 percent of YFT are large and 52 percent are small or medium/small.

Table 6. Port-Inspector Sampled Catch by Fish Size and Set Type, 2000–2017

	DEL Sets	NOA Sets	OBJ Sets	All Sets
Catch by Species and Size Within Sampled Sets				
Small Bigeye Tuna < 2.5 kg	0	512	89,927	90,439
Medium Bigeye Tuna 2.5–15 kg	10	5,173	483,276	488,459
Large Bigeye Tuna 15+ kg	38	7,674	395,218	402,930
All Bigeye Tuna in Samples	**48**	**13,359**	**968,421**	**981,828**
Small Yellowfin Tuna < 2.5 kg	7,750	9,922	112,795	1,525,195
Medium Yellowfin Tuna 2.5–15 kg	789,871	272,246	332,611	3,619,391
Large Yellowfin Tuna 2.5 + kg	1,794,878	255,885	173,899	2,224,662
All Yellowfin Tuna	**2,592,500**	**538,053**	**619,305**	**3,749,857**
Percent in Size Categories by Species and Set Type				
Small Bigeye Tuna < 2.5 kg	0%	4%	9%	31%
Medium Yellowfin Tuna 2.5–15 kg	21%	39%	50%	48%
Large Bigeye Tuna 15+ kg	79%	57%	41%	41%
All Bigeye Tuna	**100%**	**100%**	**100%**	**100%**
Small Yellowfin Tuna < 2.5 kg	0%	2%	18%	21%
Medium Yellowfin Tuna 2.5–15 kg	30%	51%	54%	49%
Large Yellowfin Tuna 15.0 + kg	69%	48%	28%	59%
All Yellowfin Tuna	**100%**	**100%**	**100%**	**100%**

Source: Developed by Northern Economics based on port-inspector sample data provided by IATTC.

The upper half of Table 6 shows the weight of fish in tons included in the MFR samples from each set type for BET and YFT. For example, a total of 48 mt of BET were sampled from dolphin sets and were evaluated in terms of size over the 18-year period. Similarly, a total of 13,359 mt of BET were sampled and evaluated from NOA sets, while 968,421 mt were sampled and evaluated from OBJ sets. For YFT, volumes of sampled fish (as demonstrated in Table 6) are relatively high for all three set types, and an examination of annual data reveal that the samples are robust for all years.

Given the expressed concerns regarding sustainable harvest resulting from increasing harvests of BET and YFT that are not yet sexual mature, along with the scientific evidence that sexual maturity of BET and YFT

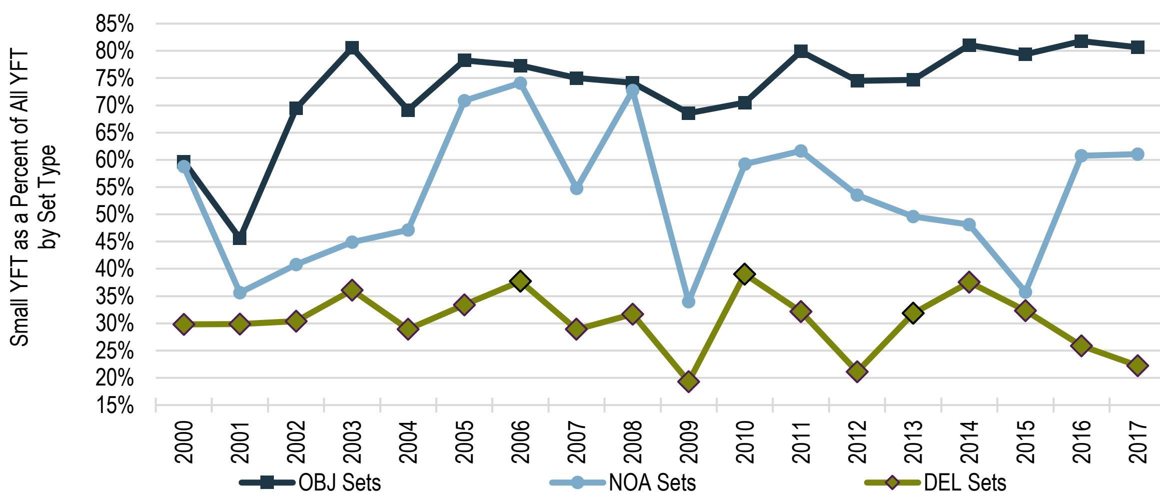
[10] at http://www.soest.hawaii.edu/PFRP/biology/itano/itano_yft.pdf

occurs after individuals reach 15 kg, the NEI Team has chosen to combine the small and medium size categories reported in the MFRs as shown in Table 6 into a single "small" category comprising all fish < 15 kg.

Figure 33 shows the percentages of small YFT (<15 kg) relative to all YFT in MFR samples by set type from 2000 to 2016. The percentage of small YFT in OBJ sets is relatively stable, and since 2014 has averaged 80.8 percent. In DEL sets, the percentage of small YFT has varied between 20 to 40 percent, and since 2014 has been declining, but has averaged 31.6 percent. Small YFT in NOA sets have been more volatile than for either of the other two set types, ranging between 34 and 74 percent. Since 2014, small YFT averaged 51.4 percent in unassociated sets—2.1 percentage points less than their long-term average of 55.5 percent.

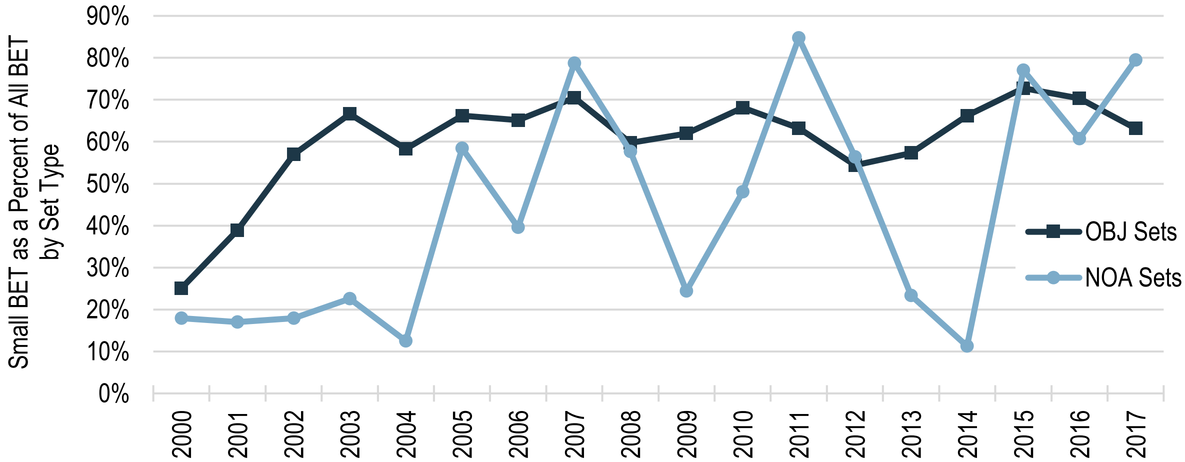
Figure 34 summarizes the percent of small BET (< 15 kg) relative to all BET by set type from 2000 to 2016, noting that BET in DELs are not included because they are extremely rare in DEL sets. The percent of small BET in OBJ sets is relatively stable after increasing from the early years. Since 2002, the percent of small BET in OBJ sets has ranged between 53 and 74 percent with most years between 60 and 70 percent. Small BET in NOA sets are much more variable. From 2000 to 2004, percentages of small (< 15 kg) YFT in NOA sets ranged between 12 and 22 percent. From 2005 to 2017, variability increased with low percentages in three years (between 10 and 25 percent) and high percentages in four years (from 77 to 85 percent). The fact that similar variability is seen for small YFT taken in NOA sets may be an indication that the characteristics of NOA sets are also highly variable—in some years NOA sets may be more closely associated with floating objects and FADs and thus are more likely to have high levels of small BET.

Figure 33. Small (<15 kg) Yellowfin as a Percent of all Yellowfin by Set Type and Year, 2000–2017



Source: Developed by Northern Economics using IATTC data.

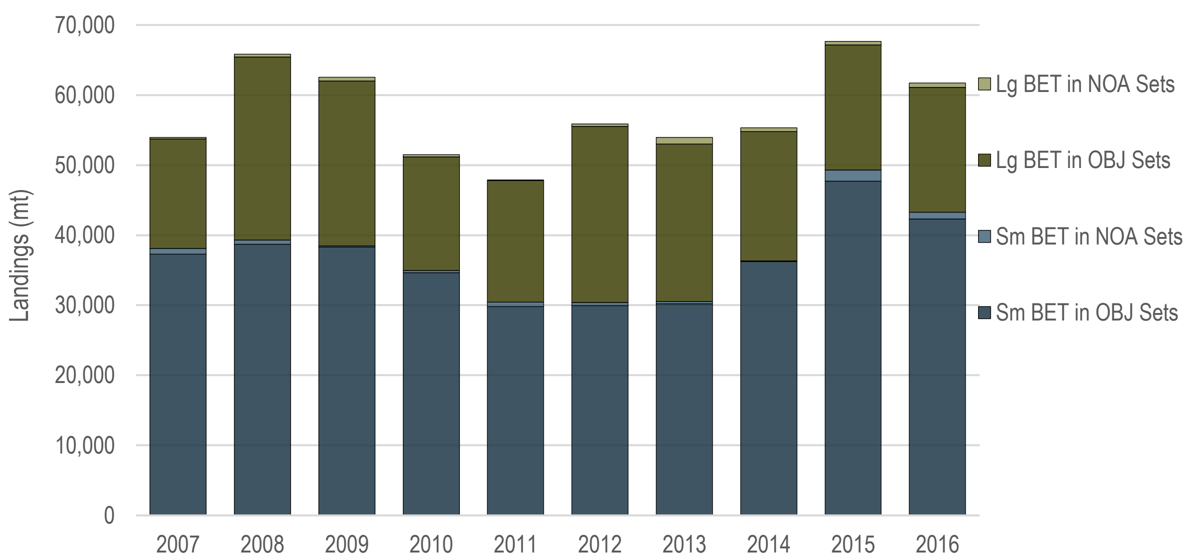
Figure 34. Small (<15 kg) Bigeye as a Percent of All Bigeye by Set Type and Year, 2000–2017



Source: Developed by Northern Economics using IATTC data.

Figure 35 summarizes estimates of landings of Small BET and Large BET by set type and year, noting that the amount of BET taken in DEL sets is too small for inclusion. This chart was developed by applying the percentages of small and large BET by set type depicted in Figure 34 to total BET landings by year. Over the entire historical period shown, OBJ sets accounted for 98 percent of all small BET.

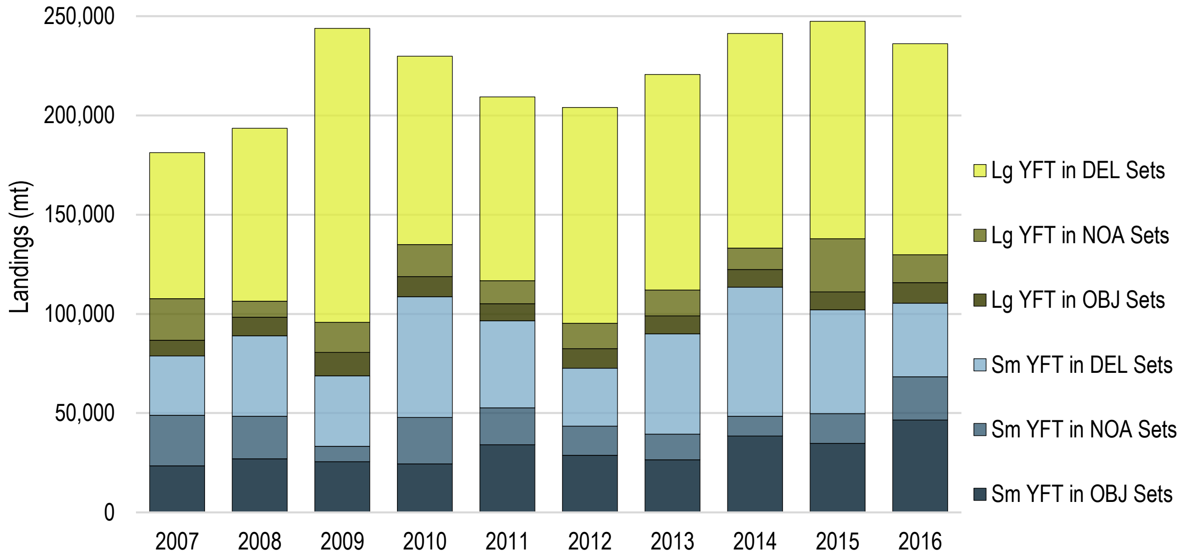
Figure 35. Annual Landings of Small and Large Bigeye Set Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 36 summarizes harvests of Small and Large YFT by set type and year. In the case of YFT, each of the three set types harvest measurable amounts of both sizes of YFT. By far the largest component of YFT landings are Large YFT in DEL sets. DEL sets also account for the largest amounts of Small YFT with the exception of 2016, when landings of small YFT in OBJ sets exceeded Small YFT in DEL sets. Over the entire historical period (2007–2016), 51 percent of all small YFT were taken in DEL sets while, OBJ sets accounted for 31 percent and NOA sets accounted for 18 percent.

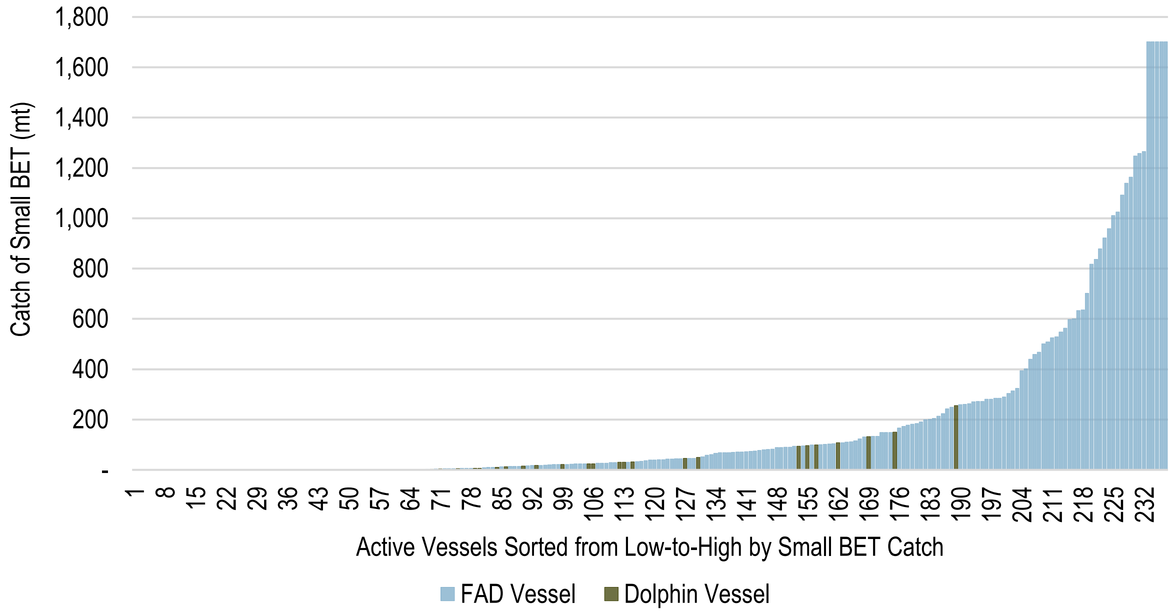
Figure 36. Annual Harvests of Small and Large Yellowfin Tuna by Set Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

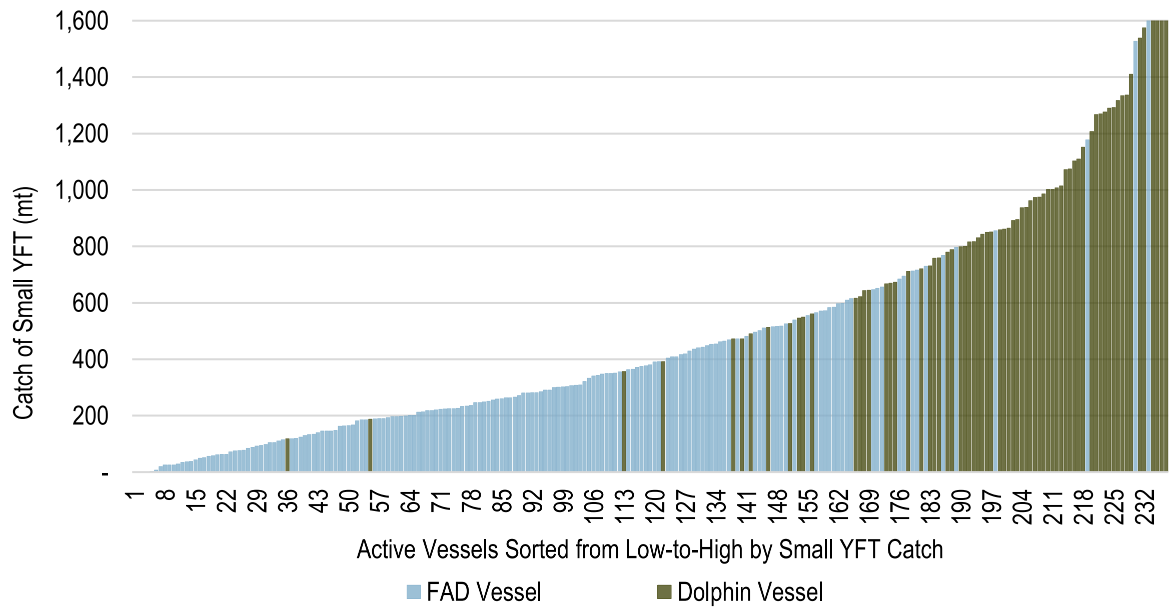
In Figure 37, the 237 vessels active in 2016 are sorted from low to high based their estimated harvest of small BET—to ensure confidentiality, catches shown for the top five vessels reflect the average harvest of those vessels. Figure 38 shows individual vessel harvests of small YFT. The chart showing harvests of small BET is much more concave than the chart for YFT indicating that a much higher percent of the total catch of small BET is taken by top 20 vessels than is the case for small YFT. In fact, the top 10 percent of vessels with respect to small BET caught 60 percent of the total small BET, while the top 10 percent of vessels with respect to small YFT caught only 25 percent of the total small YFT. The distributional differences mean that limiting harvests of small YFT is likely to affect many more operations than limits on harvests of small BET.

Figure 37. Estimated Catch of Small BET by Vessel in 2016



Source: Developed by Northern Economics using IATTC data.

Figure 38. Estimated Catch of Small YFT by Vessel in 2016



Source: Developed by Northern Economics using IATTC data.

2.2 Summary of Revenues, Costs and Net Operating Revenues

This section comprises an overview of revenue and cost data, includes estimation of net operating revenues, and provide the results of simulation model used estimate of the present value of future earnings in the EPO purse seine fishery.

2.2.1 Baseline Price Data

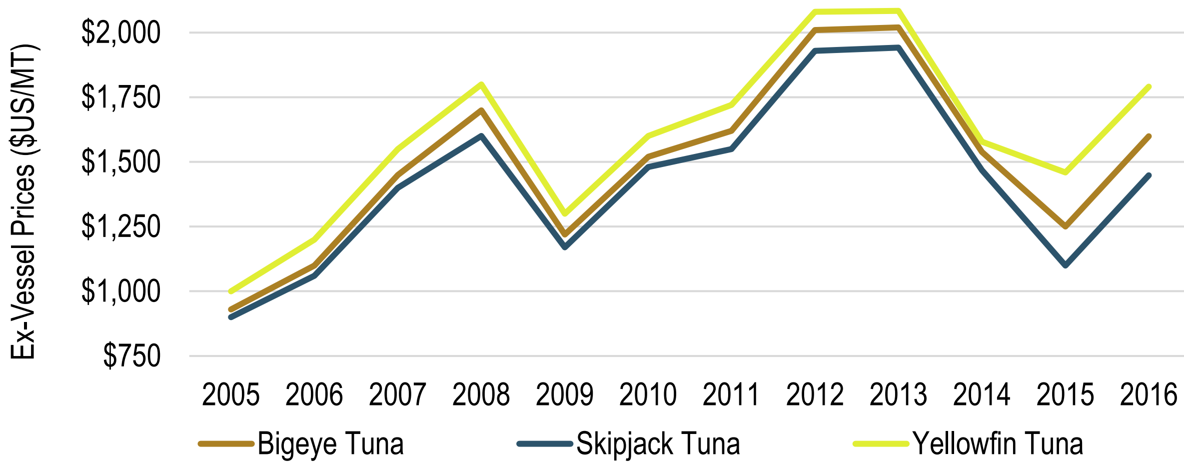
EPO tuna prices are set in relation to tuna harvesting activity and ex-vessel prices in the WCPO, the largest source of global tuna supplies. As such, EPO harvesters tend to be price takers with little bargaining power in price negotiations. The prices that are used as a reference for the ex-vessel prices in the EPO countries are the ones listed in the Bangkok Tuna Market, which have been highly volatile over the last 6 years. For this report, we use prices from Ecuador as the referential prices across the EPO region; and as can be observed in Table 7 and Figure 39, the price volatility has been greater during recent years (2010–2015) as compared to price volatility from 2005 to 2010. Prices for 2016 are estimated based on information from ww.atuna.com. Interviews with Mexican vessels generated the single point estimate used for PBF ($4,000/mt). Harvests of other species (primarily black skipjack and bonitas) comprise only 1.75 percent of total EPO tuna harvest. Price estimates for these minor species are unavailable, and for purposes of this analysis, these harvests are assigned the same price as SKJ.

Table 7. Summary Statistics on Prices for BET, SKJ and YFT During the Period 2005–2015

Period	Statistics	SKJ ($/mt)	BET ($/mt)	YFT ($/mt)
Total Period 2000 – 2015	Mean	1,418.18	1,487.64	1,579.27
	Volatility	339.57	349.08	338.66
First Half 2000 – 2010	Mean	1,268.33	1,320.00	1,408.33
	Volatility	268.66	286.98	293.97
Second Half 2010 – 2015	Mean	1,578.33	1,660.67	1,753.67
	Volatility	318.55	303.17	267.38

Source: Developed by the NEI Team using data provided by Ecuadorian boat owners.
Note: These prices are not inflation adjusted. Volatility is defined as the standard deviation of the prices.

Figure 39. Referential Annual Prices/mt of BET, SKJ, and YFT, 2005–2016

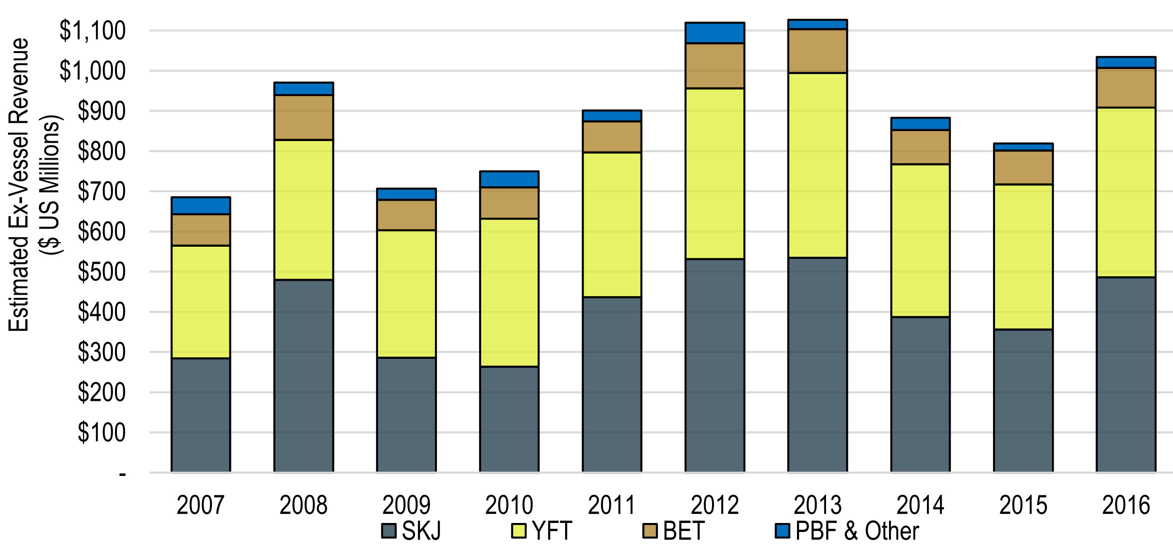


Note: These prices are not inflation adjusted.
Source: Ecuadorian vessels owners augmented with data from www.atuna.com.

2.2.2 Gross Revenues Generated in the EPO Purse Seine Fishery

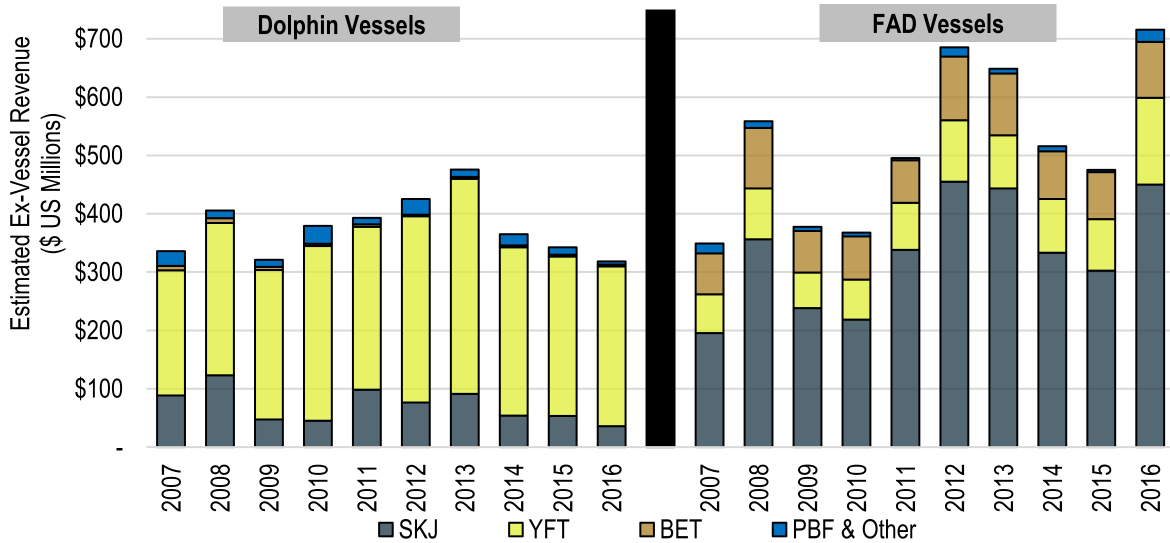
This section summarizes estimated gross revenues in the EPO purse seine fishery generated by multiplying estimated ex-vessel prices/mt from Figure 39 by landings for each species. As shown in Figure 40, SKJ and YFT are the most important species in terms of revenue, with BET a distant third. Since 2007, 45 percent of all revenue from the fishery came from SKJ, while YFT generated an average of 41 percent. Figure 41 shows the distribution of gross revenues by vessel type. FAD vessels which focus on SKJ have had more revenue volatility than Dolphin vessels. Note also that during the period shown, in the aggregate Dolphin vessels had their worst revenue year in 2016 while FAD vessels had their best year. Dolphin vessel revenue declines are tied to harvest declines in 2016 resulting from low rates of catch per set experienced in 2016. (See Figure 21 on page 26 and Figure 27 on page 29.)

Figure 40. Estimated Gross Revenue by Species, 2007–2016



Source: Developed by Northern Economics using IATTC data.

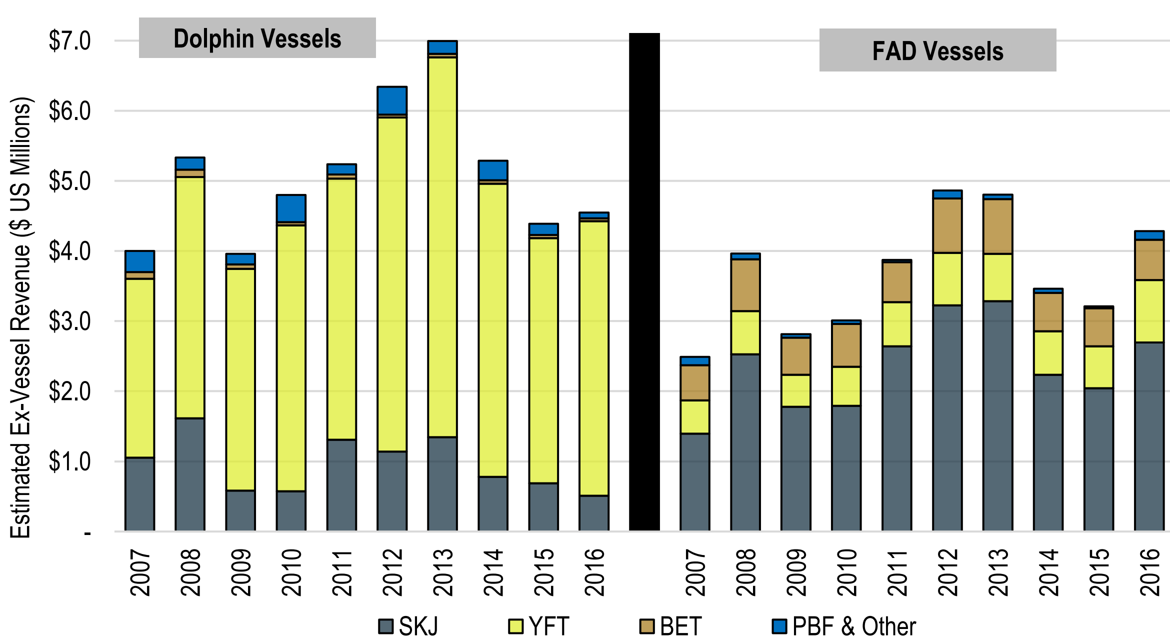
Figure 41. Estimated Gross Revenue by Species and Vessel Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 42 show gross revenues by vessels type. From 2007 to 2016, Dolphin vessels (which are on average larger than FAD vessels) generated 38 percent more revenue/vessel than FAD vessels. During 2016 however, the difference was only 6 percent.

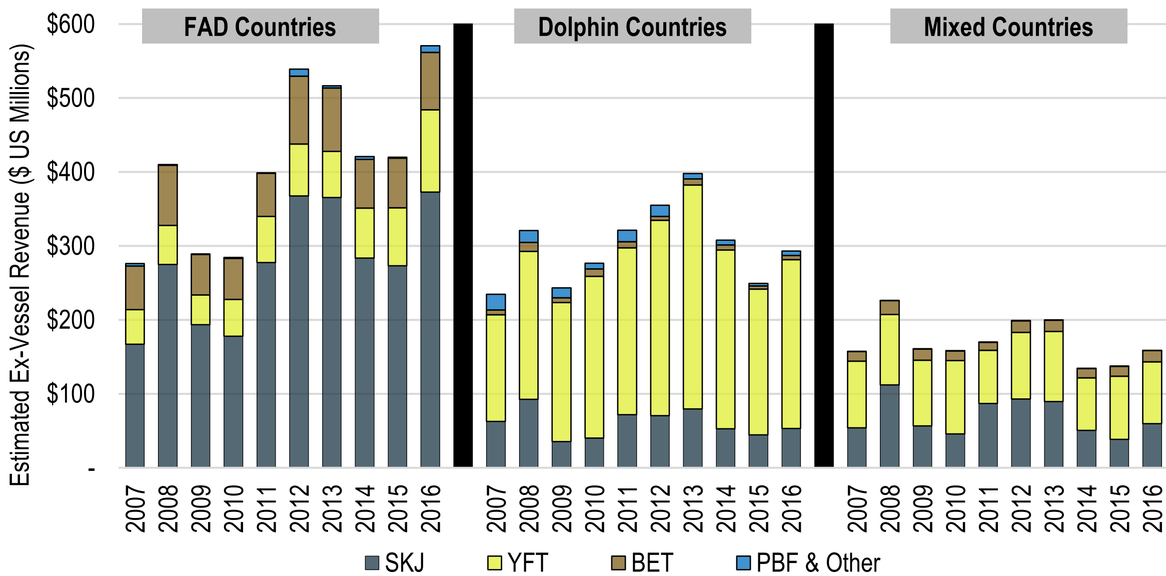
Figure 42. Estimated Gross Revenue per Vessel by Species and Vessel Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 43 summarizes total revenues generated in the EPO purse seine fishery by country type. Since 2007, FAD countries have generated 47 percent of the total revenue in the fishery, followed by Dolphin countries with 34 percent and Mixed countries with 19 percent.

Figure 43. Estimated Gross Revenue by Species and Country Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

2.2.3 Estimated Operating Costs in the EPO Purse Seine Fishery

The NEI Team obtained financial data from 22 purse-seine boats that belong to Ecuador (11 boats), Mexico (10 boats) and Panama (1 boat). This cost information was gathered through a separate grant. The vessels that provided cost data gave information for the eighteen factors listed below.

Table 8. Cost Factors Collected from Vessels that Provided Cost Information

Vessel Carrying Capacity (mt)	Maximum Days at Sea	Average trip duration (days)
Use of fuel per year (gallons)	Use of fuel per trip (gallons)	Use of fuel per day(gallons)
Fuel cost per trip	Fuel cost per day	Number of crew per vessel
Labor cost per mt of catch	Labor cost per trip	Labor cost per day
Other operation costs per trip	Other operation costs per day	Total Operation Cost per day
Catch expected per trip	Catch expected per year	Other costs per year

After working through the cost data collected from the Mexican vessel owners, the NEI Team compared data to cost data previously compiled for vessels from Ecuador. An important finding is that the operating costs data collected for the Mexican fleet were noticeably higher than the costs collected from Ecuadoran vessels. The NEI Team compared the average vessel cost of Mexican vessels with average costs of the U.S. fleet through discussions with knowledgeable industry experts and found that costs of the two fleets were very similar. We therefore believe that applying estimated operating costs of the Mexican fleet to the U.S. fleet appears to be a reasonable assumption:

- Vessels from Mexico and the U.S. will be assigned costs based on data collected from the Mexican Fleet. In addition, costs of vessels from other "developed" countries (i.e. the European Union [E.U.]) will also use costs based on cost data from the Mexican Fleet.
- Operating costs of vessels from Ecuador as well as vessels from other "developing" countries will be based on costs developed by Bucaram (2017) in his earlier study after adjusting for fuel costs.
  - Fuel costs for vessels from Columbia are set equal to fuel costs for Ecuador. This is based on a comparison of fuel costs in Columbia and Ecuador.
  - Fuel costs for vessels from all other developing countries are set at three times the fuel costs for Ecuador. The "3×" factor is based on average fuel cost data over the period for the other countries compared to fuel costs in Ecuador.

We also note that one of the cost components is an annual participation cost that is charged to all vessels that are active during the year. These costs are not truly fixed costs, because they only accrue to vessels that are active in a given year—for example, if during a three-year period a vessel participated in year 1, was inactive in year 2, and then participated again in year 3, the "participation cost" will only be assigned to the vessel during Years 1 and 3.

The NEI Team has made the decision to apportion these "annual participation costs" based on the vessel's percentage of Days at Sea (DAS) that were spent in the EPO. We assume that DAS indicating the vessel is not physically located in the EPO implies that they are operating in the WCPO. Therefore, the annual participation cost should be borne by both the EPO and WCPO fisheries. (We note here that we only have harvest and revenue information for the EPO fishery.) As an example, a vessel that had 250 DAS in total, but only 200 EPO DAS would be assigned 80 percent of the total participation cost estimated for the vessel. All other operating costs that vary by DAS will utilize EPO days only.

We assumed that the cost data from the vessels from Mexico and Panama were representative of vessels operating in higher-cost, more developed countries including Mexico, the United States and the E.U. Cost data from the vessels from Ecuador of developing countries in Central and South America.

To extrapolate the representative cost structures for all the boats that participate in the EPO, we estimated a set of linear relationships between cost per day for each cost category and carrying capacity. It is important to emphasize that we have a small number of observations (4 observations for FAD fishery and 3 observations for Dolphin fishery). The small number of observations is not considered a major issue because we are not looking to determine a causal relationship between carrying capacity and the cost per day, but to determine an average of the cost per day for each level of carrying capacity.

The categories of costs per day that will be estimated are Labor, Fuel, and Other Operative Costs. The equation for developing the estimate is as follows:

$Cost\ per\ day_i = \alpha + \beta(Carrying\ Capacity) + \varepsilon$; *w*here *i* = labor, fuel & other operative costs; and ε is the error of the linear model. (1)

We also estimated an additional regression for the annual participation costs that the boat must incur to participate in any year. The equation for developing the estimate is as follows:

$Annual\ Participation\ Cost = \alpha + \beta(Carrying\ Capacity) + \varepsilon$; where ε is the error of the linear model. (2)

The estimated values for the four models (three for the different categories of the costs per day and one for annual participation costs) are given in Table 9 with the upper portion summarizing models based on representative vessels from Ecuador, and the lower portion summarizing models based on representative vessels from Mexico and Panama data.

Table 9. Regression Model Estimators for Three Cost/Day Categories and for Annual Participation Cost

Regression Model Estimators Based on Data from Ecuador				
	Cost per day (Category)			Annual
Estimator	Labor	Fuel	Other	Participation Cost
Alpha (*α – the intercept term*)	133.40	63.62	-100.83	342,822.59
Beta (*β – the regression coefficient)*	3.41**	2.02**	4.38***	717.47*
R-Squared	0.93	0.92	0.99	0.97
F statistic	24.82	23.34	171.73	35.64
Regression Model Estimators Based on Data from Mexico and Panama				
	Cost per day (Category)			**Annual**
Estimator	**Labor**	**Fuel**	**Other**	**Participation Cost**
Alpha (*α – the intercept term*)	7,000.00	1,922.06	3,731.08	496,611.21
Beta (*β – the regression coefficient)*	0.00*	3.32**	2.53*	406.15*
R-Squared	0.91	0.99	0.93	0.91
F statistic	108.52	281.77	114.01	107.15

Note: Significance levels for *β* coefficients are indicated by the number of * as follows: *** indicates significance at the 1% level of confidence, ** indicates significance at the 5% level of confidence and * indicates significance at 10% level of confidence.

Then to calculate the total annual cost for fuel, labor and other operative costs we apply the following formula to each boat:

$$Total\ Annual\ Operative\ Cost_{ik} = \left[\hat{\alpha} + \hat{\beta} \times Carrying\ Capacity_k\right] \times EPO_k; \quad (3)$$

where *i* = labor, fuel & other operative costs; *k* is an identification index for the boat; and EPO_k is the number of days at the sea in the EPO for boat *k*

To calculate the annual participation cost of a boat we apply the following formula:

$$Annual\ Participation\ Cost_k = \left[\hat{\alpha} + \hat{\beta} \times Carrying\ Capacity_k\right] \times \left[EPO_k \div DAS_k\right] \quad (4)$$

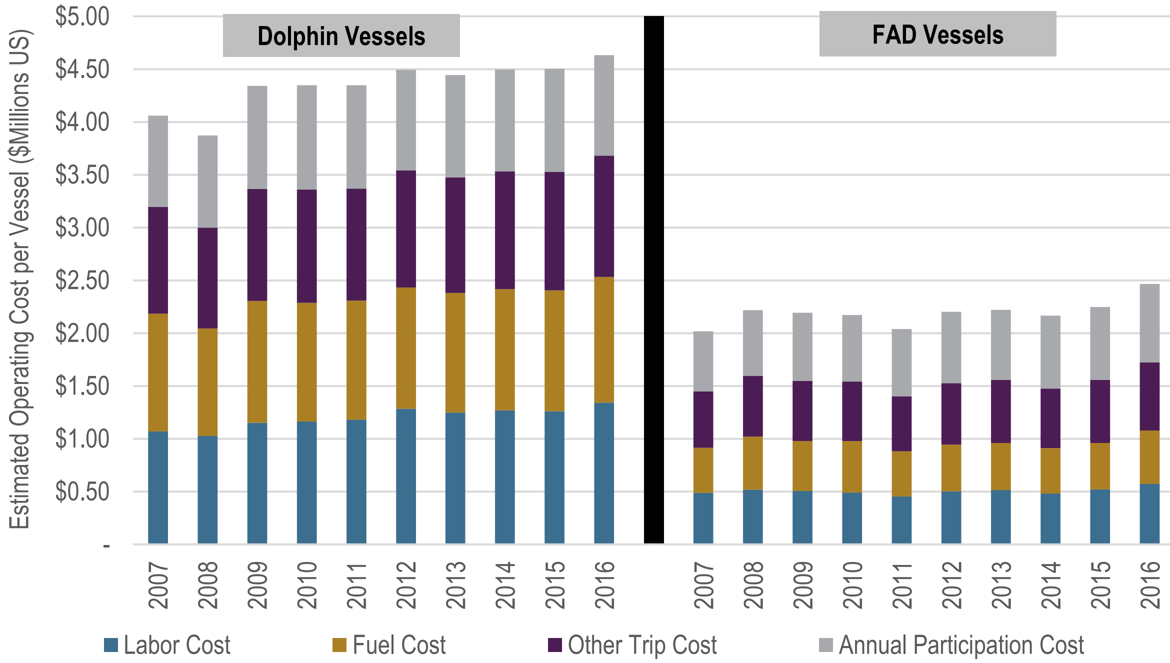
where *k* is an identification index for the boat; and EPO_k is the number of days at sea within the EPO for boat *k; and* DAS_k is the total DAS (regardless if located in the EPO) for boat *k.*

We used the estimated parameters for the Mexican and Panamanian boats to calculate the annual operative and the annual participation costs of boats from Mexico, the U.S. and the E.U. In the case of the parameters estimated from the information of the Ecuadorian boats, they were used without adjustment to estimate the annual operative and the participation costs of boats from Ecuador and Columbia. Costs for all other Central and South American Countries were estimated using the estimated parameters from Ecuadorian boats after making a fuel cost adjustment. For these other countries, fuel costs were multiplied by 3, based on the relative difference between the diesel cost in Ecuador ($0.9 per gallon) and the average diesel cost in other countries in South and Central America ($2.7 per gallon).

Figure 44 summarizes the estimated annual operating cost per vessel for Dolphin vessels and FAD vessels from 2007 to 2016. Average annual operating costs of Dolphin vessels are estimated to be 98 percent higher than operating costs of FAD vessels. A discussion of the reasons for higher costs follows the figure.

The NEI Team notes that while costs are estimated for each year, cost factors (such as the price of fuel for example) are constant across all years.

Figure 44. Estimated Operating Cost per Vessel by Vessel Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

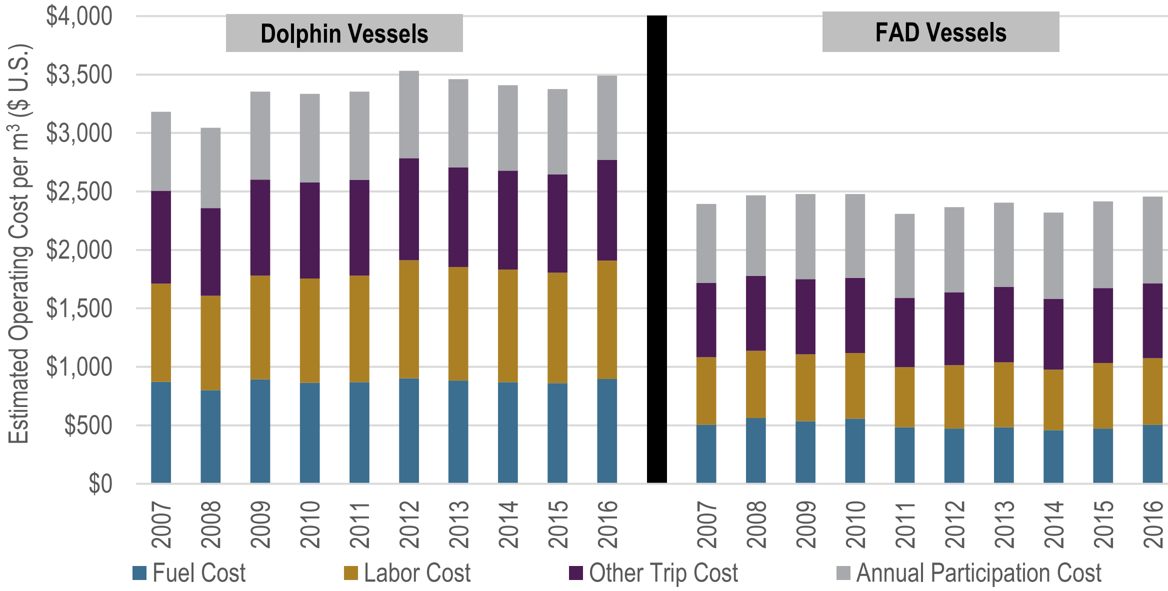
There are several factors that explain why operating costs for Dolphin vessels are higher than operating costs for FAD Vessels:

- The majority of FAD Vessels are from Ecuador, where there is a fuel subsidy and relatively lower labor costs. (See the discussion above on the fuel cost differential.)
- The largest number of Dolphin Vessels are from Mexico, and Mexico along with the U.S. and the E.U. are assigned higher operational cost data by the NEI Team based on the cost data collected and reviewed.
- Dolphin Vessels have, on average, greater hold capacity than FAD Vessels, and costs increase with capacity. (See Figure 8 on page 18.)
- Dolphin Vessels, on average, operate for more EPO DAS per year than FAD Vessels, and costs increase with EPO DAS. (See Figure 11 on page 21.)
- Dolphin Vessels have a lower percentage of non-EPO DAS, and annual participation costs increase with higher percentages of EPO DAS. (See Figure 11 on page 21.)

The cost estimates depicted in Figure 44 have been presented to members of the industry in both Mexico and Ecuador, and in general there was agreement that these cost differentials exist, and that the magnitudes of the of differential are not unreasonable.

Figure 45 summarizes operating cost by capacity (m^3) for each of the two vessel types. On average, dolphin vessel operating costs are $945/$m^3$ higher than operating costs for FAD vessels. Over the 10-year period shown, Dolphin vessels' operating costs averaged $3,353/$m^3$ while FAD vessels' operating costs averaged $2,408/$m^3$.

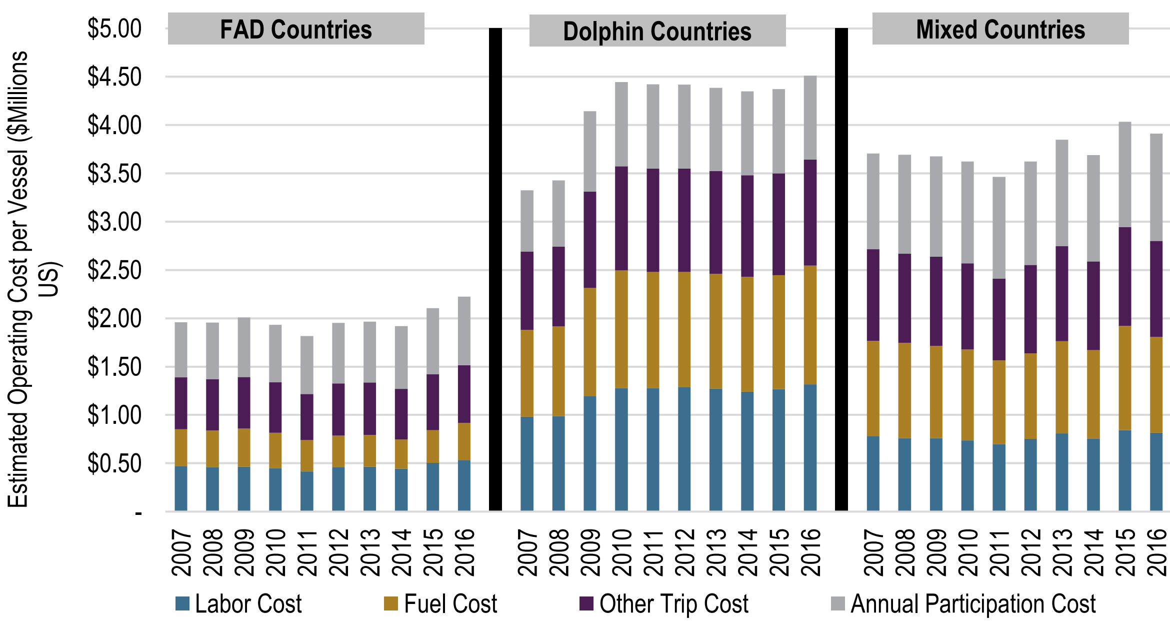
Figure 45. Estimated Operating Cost per Cubic Meter of Hold Capacity by Vessel Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 46 summarizes operating costs per vessel by Country type. Costs of vessels from Mixed countries fall between costs of vessels from FAD countries and Dolphin Countries. The average vessel from Mixed countries is 56 percent larger than the average vessel from FAD countries, operates for 24 during percent more EPO days, and has very few non-EPO days—all these factors lead to higher costs.

Figure 46. Operating Costs per Vessel by Country Type

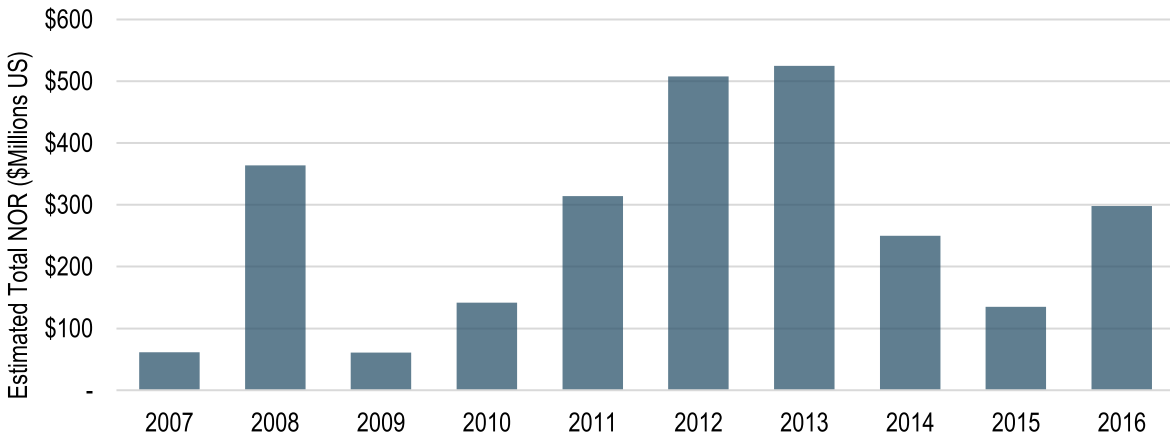


Source: Developed by Northern Economics using IATTC data.

2.2.4 Net Operating Revenues in the EPO Fishery

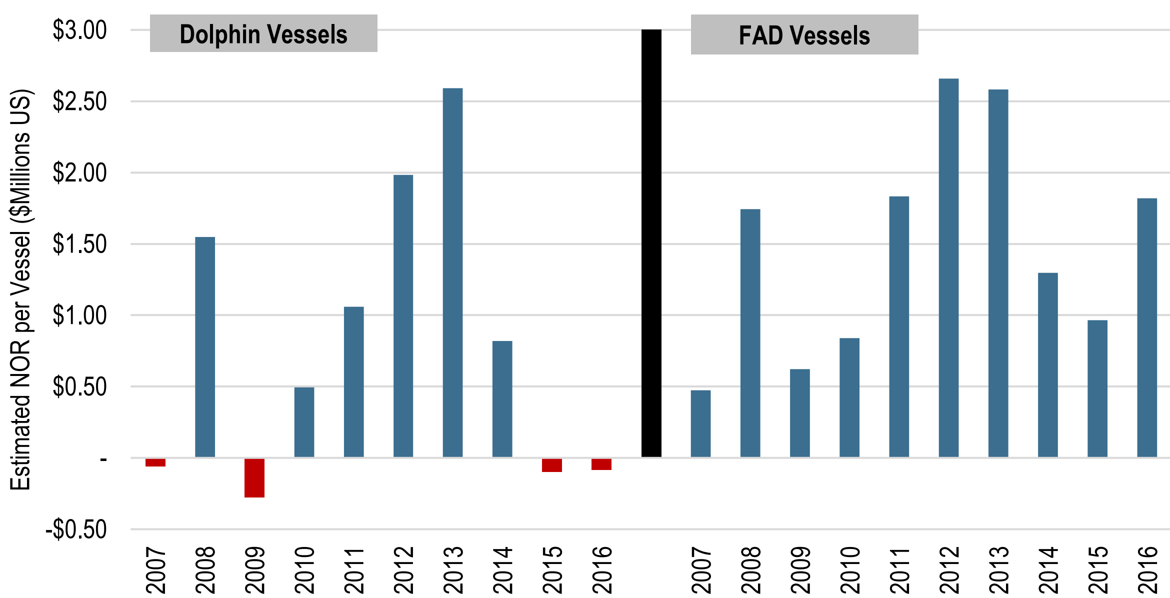
Net operating revenues (NOR) are calculated by subtracting operating costs from gross revenues. NOR is a first order estimate of profit; however, it is important to note that the NEI team has not included estimates of debt service or taxes within estimates of operating costs. Figure 47 summarizes fleet-wide NOR by year, while Figure 48 drills down to show average NOR/vessel by vessel type. These figures demonstrate the inherent volatility of NOR for fishing vessels as well as the differences between vessel types. For Dolphin vessels 2007, 2009, 2015 and 2016 were very bad years, while 2016 generated the third highest NOR for FAD vessels. Declines in 2014 and 2015 are most likely linked to price declines in those years (see Figure 39 on page 41), while declines for Dolphin vessels in 2016 are linked to declines in catch rates per set.

Figure 47. Estimated Fleet-wide NOR, 2007–2016



Source: Developed by Northern Economics using IATTC data.

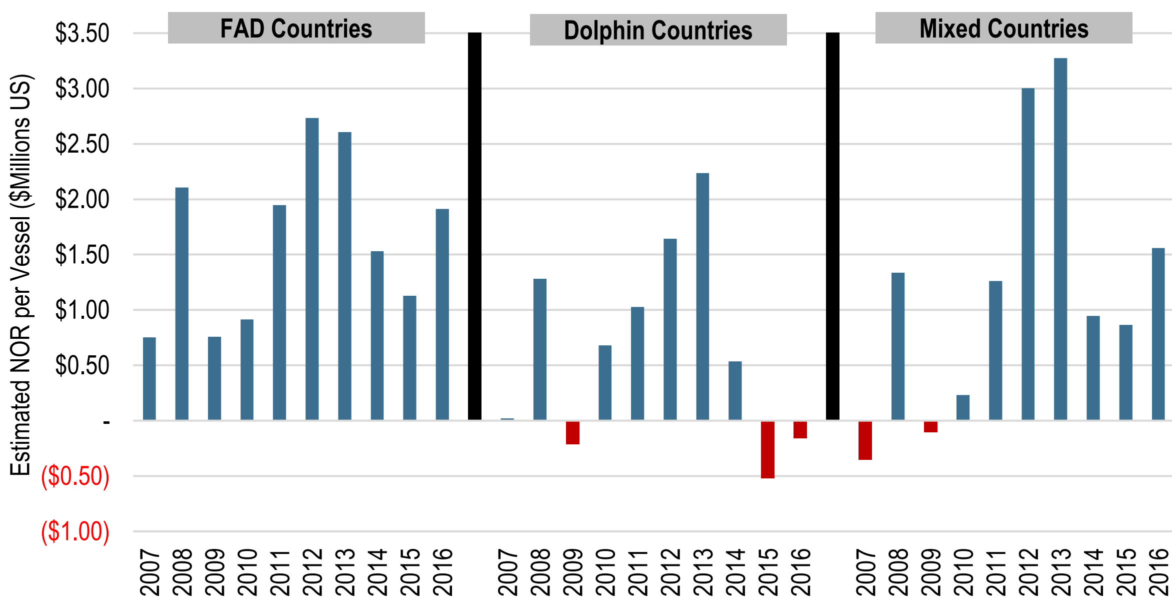
Figure 48. Estimates of NOR per Vessel by Vessel Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 49 shows NOR/vessel by country type—the average vessel from Dolphin countries is estimated to have lost over $500,000 in 2015, and vessels from Mixed countries were estimated to have lost money in 2007 and 2009.

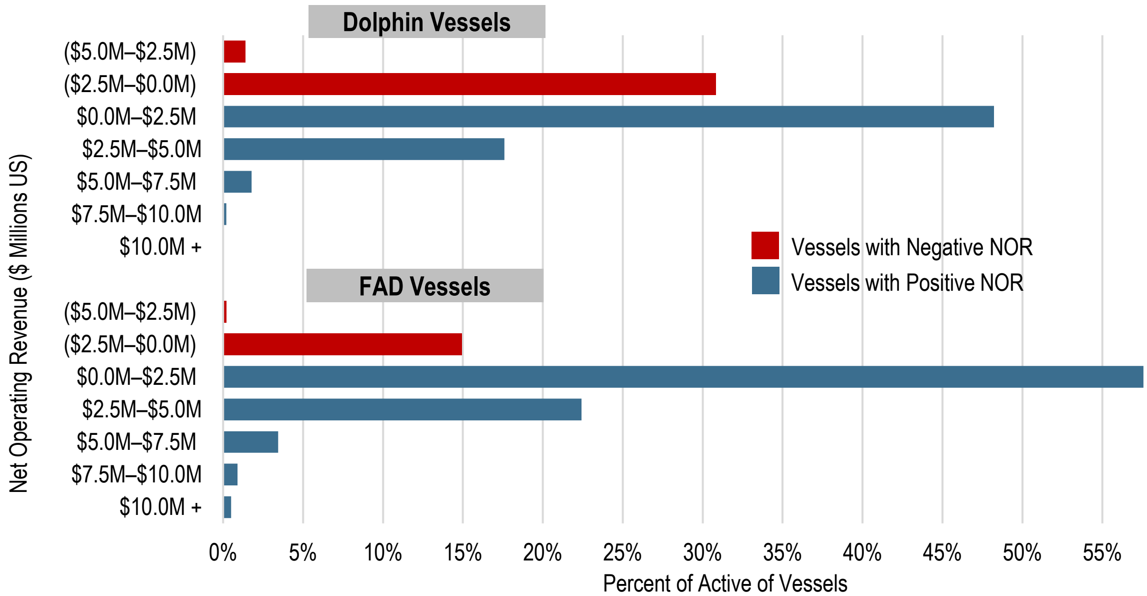
Figure 49. Estimates of NOR per Vessel by Country Type, 2007–2016



Source: Developed by Northern Economics using IATTC data.

Figure 50 summarizes the distribution of NOR from 2010 to 2016 by vessel type. In this figure, the bars sum up to 100 percent of the vessel-years for each vessel type. During this seven-year period there were an average of 72.3 operative Dolphin vessels and thus 506 Dolphin vessel years (72.3 × 7 = 506). Similarly, there were an average of 141.4 FAD vessels for a total of 990 vessel-years (141.4 × 7 = 990). The NEI Team estimates that 32 percent of all Dolphin vessel years and 15 percent of FAD vessel years generated losses (shown as red bars). Over 48 percent of Dolphin vessel years and 57.6 percent of FAD vessel years generate positive NOR between $0 and $2.5 million.

Figure 50. Distribution of Net Revenues per Vessel by Vessel Type, 2010–2016



Source: Developed by Northern Economics using IATTC data.

2.2.4.1 Estimation of the Present Value of Future Earnings

Estimation of the Present Value of Future Earnings (PVFE) for each operative vessel is an important element of this analysis because alternatives to reduce capacity include a vessel buyback as well as other related options. For the vessel buyback, it is assumed that vessel owners would be willing to forego future participation in the fishery if they are compensated by an amount that approaches or equals their own expectations of future earnings in the fishery—i.e. the PVFE for their vessel.

In this analysis, the PVFE of each vessel that was operative in 2015 or 2016 was estimated using a future earnings simulation model based on that vessel's NOR from the years 2010–2016. The simulation model uses a Monte Carlo-like process to estimate the present value of the 20-year future net operating revenue stream over 1,000 iterations. The NEI Team uses a 20-year future period rather than a 10-year period because it is assumed that vessel owners would wish to be compensated for more of their foregone future earnings than a 10-year period would provide.

The following series of three tables (Table 10–Table 12) demonstrates the functioning of the simulation model. The historical NOR for two hypothetical example vessels for the year 2010–2016 are shown in Table 10. Vessel 1 had two years of negative NOR (2011 and 2013) and was tied-up for all of 2012 and did not fish—Vessel 1 did have a great year in 2016. Vessel 2 has been a consistently profitable vessel for all seven years from 2010 through 2016.

Table 10. Estimated NOR for Two Hypothetical Vessels, 2010–2016

Historical NOR	2010	2011	2012	2013	2014	2015	2016
Vessel 1	$573,750	($115,555)	$0	($510,695)	$946,727	$1,952,854	$4,269,758
Vessel 2	$1,152,517	$2,274,094	$3,539,581	$2,537,303	$1,554,666	$1,120,562	$1,557,847

Table 11 demonstrates the 3-step process used for a single iteration of the simulation model for the two hypothetical example vessels over a 20-year future period. In Step 1, historical years from 2010 to 2016 are randomly drawn to represent each future year—each year from 2010 to 2016 has an equal likelihood to be drawn for each of the future years.

In Step 2, the NOR from the randomly selected historical year is entered to represent the nominal NOR for the future year. For Vessel 1, 2012 is selected to represent Future Year 1, and since Vessel 1 was tied up in 2012, its NOR for Future Year 1 is zero. For Vessel 2, 2014 was selected to represent both Future Year 1 and Future 2, and thus the nominal NOR for those years are set equal to $1,554,666.

The simulation model assumes that future year earnings are discounted by 12 percent each year—a discount rate that is appropriate for commercial business decision making. Future Year 1 NOR are not discounted, but Future Year 2 NOR will be discounted by 12 percent, and Future Year 3 NOR will have a cumulative discount of 77 percent. The discount factors (*df*) for each year are shown in the table and use the standard discounting formula $df = (1 - r)^{(FY - 1)}$, where *df* is the discount factor, *r* is the discount rate and *FY* is the Future Year.

In Step 3, the *df* is multiplied by the nominal NOR for future years from Step 2. Finally, in Step 4 (shown as the bottom row in Table 11), the discounted future year NOR are summed over the 20-year period to arrive at the Present Value of Future Earnings for Iteration 1 ($PVFE_1$). For Vessel 1, $PVFE_1$ = $10.88 million, while the $PFVE_1$ for Vessel 2 = $13.62 million.

Table 11. Calculation of PVFE for Iteration 1 for Two Hypothetical Vessels

	Step 1: Randomly select historical years to represent future years		Step 2: Insert historical NOR as the proxy for nominal future year NOR		Discount Factor (*df*) for future years (12%/year)	Step 3: Multiply future year NOR by the future year *df* to calculate the PVFE for Iteration 1	
	Vessel 1	Vessel 2	Vessel 1	Vessel 2		Vessel 1	Vessel 2
Future Year 1	2012	2014	$0	$1,554,666	100%	$0	$1,554,666
Future Year 2	2011	2014	($115,555)	$1,554,666	88%	($101,688)	$1,368,106
Future Year 3	2016	2011	$4,269,758	$2,274,094	77%	$3,306,500	$1,761,058
Future Year 4	2013	2016	($510,695)	$1,557,847	68%	($348,025)	$1,061,629
Future Year 5	2015	2015	$1,952,854	$1,120,562	60%	$1,171,118	$671,996
Future Year 6	2010	2016	$573,750	$1,557,847	53%	$302,786	$822,126
Future Year 7	2016	2015	$4,269,758	$1,120,562	46%	$1,982,893	$520,393
Future Year 8	2015	2015	$1,952,854	$1,120,562	41%	$798,084	$457,946
Future Year 9	2014	2012	$946,727	$3,539,581	36%	$340,476	$1,272,955
Future Year 10	2016	2011	$4,269,758	$2,274,094	32%	$1,351,286	$719,702
Future Year 11	2012	2013	$0	$2,537,303	28%	$0	$706,641
Future Year 12	2014	2016	$946,727	$1,557,847	25%	$232,025	$381,799
Future Year 13	2016	2016	$4,269,758	$1,557,847	22%	$920,864	$335,983
Future Year 14	2010	2012	$573,750	$3,539,581	19%	$108,892	$671,779
Future Year 15	2014	2016	$946,727	$1,557,847	17%	$158,118	$260,185
Future Year 16	2014	2013	$946,727	$2,537,303	15%	$139,144	$372,917
Future Year 17	2013	2015	($510,695)	$1,120,562	13%	($66,052)	$144,930
Future Year 18	2016	2014	$4,269,758	$1,554,666	11%	$485,969	$176,947
Future Year 19	2014	2016	$946,727	$1,557,847	10%	$94,823	$156,032
Future Year 20	2012	2011	$0	$2,274,094	9%	$0	$200,438
Step 4: Present Value of Future Earnings for Iteration 1 (PVFE = Sum of Discounted NOR)						**$10,877,213**	**$13,618,229**

The entire process demonstrated in Table 11 is then repeated (iterated) 1,000 times. The final estimates of the PVFE for each vessel equal the average PVFE over all 1,000 iterations. The averaging process is represented in Table 12. The PVFE for hypothetical example vessel 1 is $7.92 million, and the PFVE for hypothetical example Vessel 2 is $15.12 million.

Table 12. Calculation of Final PVFE from 1,000 Iterations for Two Hypothetical Vessels

	20-Year PVFE Iteration 1	20-Year PVFE Iteration 2	20-Year PVFE Iteration 3		20-Year PVFE Iteration 998	20-Year PVFE Iteration 999	20-Year PVFE Iteration 1,000	PVFE = Average of 20-year PVFE over 1,000 Iterations
Vessel 1	$10,877,213	$7,495,643	$12,594,878	→→→	$5,886,324	$13,808,216	$4,412,218	**$7,920,980**
Vessel 2	$12,835,961	$13,721,581	$18,984,246	→→→	$13,482,399	$12,385,501	$18,638,334	**$15,118,741**

The simulation model was developed in Microsoft Excel. The randomization of the selection of future years was accomplished using Excel's RANDBETWEEN function—i.e. RANDBETWEEN(2010,2016).

For the mathematically inclined, the simulation model is represented in the following equation:

$$PVFE = \sum_{i=1}^{I}\left[\sum_{fy=1}^{20} NOR_h \times (1-r)^{(fy-1)}\right] \div I; \text{ where}$$

I = the total number of iterations in the simulation, this case there are 1,000 iterations;

i = the particular iteration;

fy = *f*uture years from 1 to 20;

NOR_h = net operating revenues in historical year *h*, where h = {2010, 2011, …, 2016};

r = rate used for discounting future value, in this simulation *r* = 12%

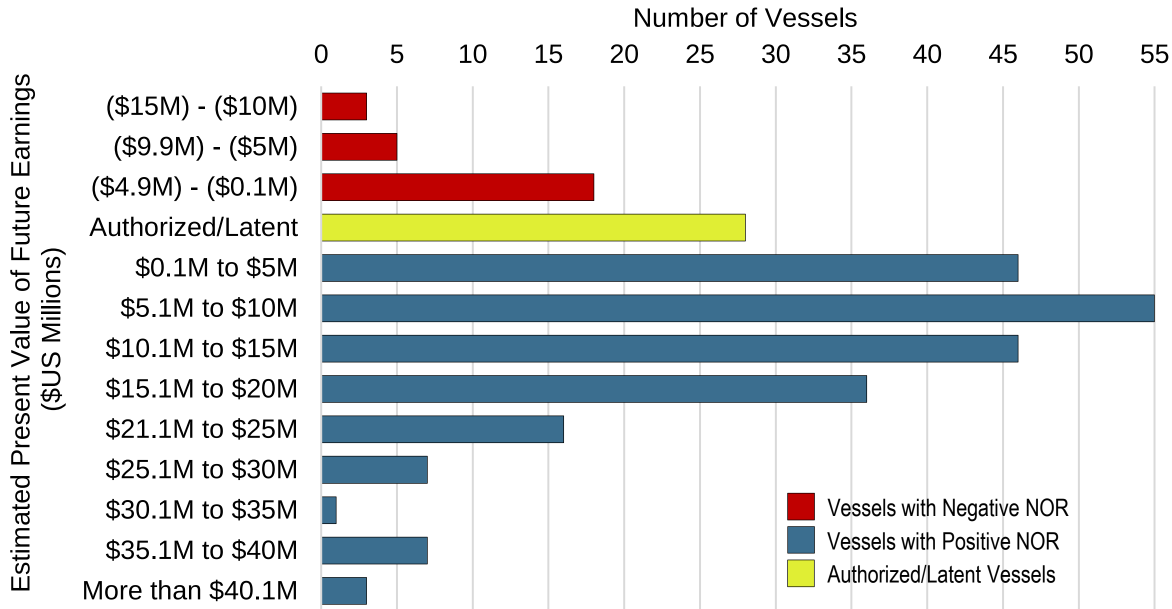
It is further noted that as the number of iterations in the simulation approaches infinity, the simulation formula to calculate PVFE can be simplified to equal the present value of the average NOR during the historical period projected out 20 years into the future, i.e.:

$$PVFE = \lim_{I\to\infty}\left\{\sum_{i=1}^{I}\left[\sum_{fy=1}^{20} NOR_h \times (1-r)^{(fy-1)}\right] \div I\right\} = \sum_{fy=1}^{20} \widehat{NOR_h} \times (1-r)^{(fy-1)}$$

Figure 51 and Table 13 on the following pages summarize the distribution of PVFE estimated from the simulation of the 243 vessels that were active in 2015 or 2016. In the figure the red bars represent the 26 vessels that are expected to generate negative PVFEs, the blue bars represent the 217 vessels expected to generate positive PVFEs, and the yellow bar represents the 28 authorized/latent vessels from the register.

The NEI Team notes that the PVFE estimated and shown in Figure 51 and Table 13 use historical prices, historical stocks, historical catch rates, and historical regulatory constraints. As such, they are imperfect estimators of future earning streams and should be used only in the context of this analysis.

Figure 51. Distribution of the Estimated PVFE in the EPO Purse Seine Fishery



Source: Developed by Northern Economics using landings data from IATTC.

Table 13 divides the 243 operative vessels into six bins of future earnings as listed in the first column, noting that the 26 vessels that are expected to lose money in the future are shown in the first row with red text. The table provides percentages of all vessels as well as percentages of dolphin and FAD vessels for each group. Note that percentages in each column sum to 100 percent. Eleven percent (26) of all vessels are expected to lose money over the next 20 years, but 15 percent of Dolphin vessels (11) and only 9 percent (15) of all FAD vessels. In other words, Dolphin vessels are projected to be more likely to lose money in the future than FAD vessels. Similarly, 23 percent of all vessels are expected to realize between $5 million and $10 million in PVFE, but 25 percent of Dolphin vessels are expected to fall into this range and only 22 percent of all FAD vessels. Table 13 also shows percentages of vessels in each PVFE category by country type. By comparing the percentages of each country type in each PVFE group to the percentages for all vessels, we can infer whether vessels from these countries are more or less likely than average to fall within a given PVFE group.

The last three columns in Table 13 provide information on three critical indicators of profitability:

- Average number of days per year the vessel was physically present in the EPO;
- Average catch (mt) per EPO day; and
- Average capacity (hold size in m^3) of vessels.

Of these three measures, only one increases with all levels of PVFE—catch per EPO day. If vessels aren't catching many fish, they are unlikely to be profitable. EPO days are relatively low for vessels in the lowest two profit groups, and relatively high for vessels with the highest PVFE.[11] Vessels with projected future

[11] The NEI Team reiterates the caveat that the data used in this analysis do not include any landings or revenues of tuna harvested outside of the EPO (i.e. in the WCPO). It is possible that vessels with fewer EPO days also fish in the WCPO, and that if the WCPO harvests and revenue were included the NOR of the vessels would increase.

losses are more likely to be larger vessels, and the average size of vessels declines as we move to higher PVFE. However, the average capacity of the most profitable vessels is relatively high.

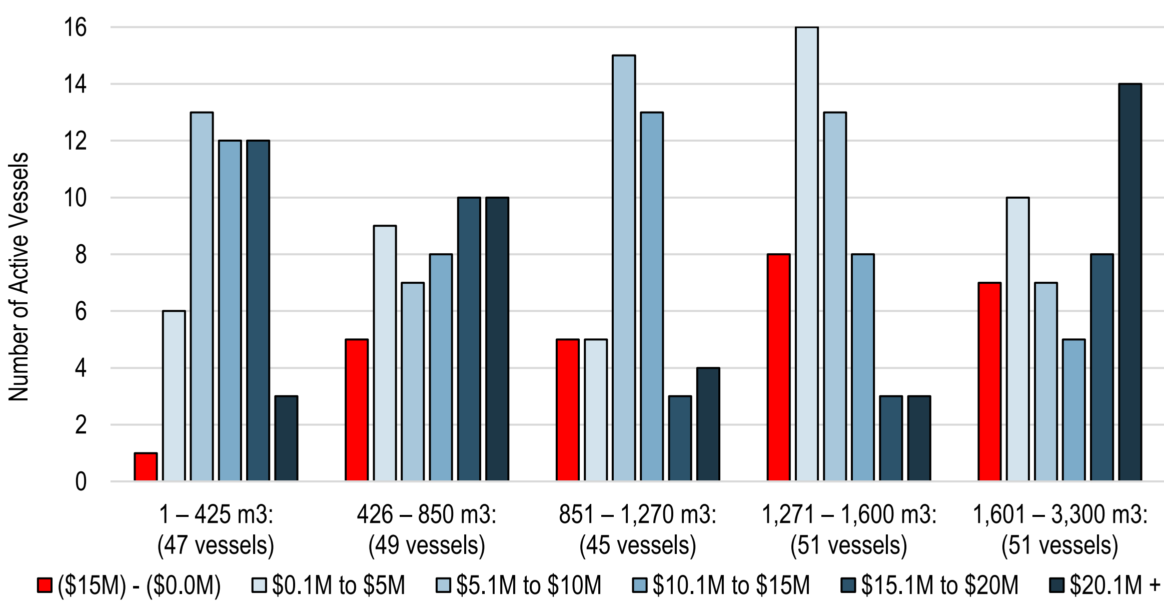
Table 13. Summary of Estimated PVFE Streams of Vessels Operative in 2015 & 2016

Range of Present Values of Future Earnings (PVFE)	All Vessels	Dolphin Vessels	FAD Vessels	FAD Countries	Dolphin Countries	Mixed Countries	EPO Days	Catch / EPO Day	Average Hold Capacity
	Percent of All Operative Vessels in Each PVFE Group						Average: 2014–2016		m³
($15.0M) - ($0.0M)	26	11	15	13	8	5	153	1,571	1,345
$0.1M to $5.0M	46	21	25	19	24	3	160	1,889	1,168
$5.1M to $10.0M	55	18	37	25	16	14	181	2,327	1,052
$10.1M to $15.0M	46	12	34	30	11	5	177	2,485	948
$15.1M to $20.0M	36	3	33	32	3	1	172	2,741	947
$20.1M +	34	6	28	24	4	6	204	4,411	1,336
All Operative Vessels	**243**	**71**	**172**	**143**	**66**	**34**	**175**	**2,546**	**1,110**

Source: Developed by Northern Economics using landings data from IATTC.

Figure 52 groups the 243 active vessels into five bins based on capacity and shows the number of vessels in that size range that fall into each PVFE group—latent vessels have been excluded from the figure. One of the significant insights provided by the figure is that profitability is not necessarily tied to the size of the vessel. Vessels in the two smaller size classes are relatively profitable compared to larger vessels. We also note the group summarizing the largest vessels in the fleet has more vessels with $20+ million in PVFE than any other group.

Figure 52. Distribution of Estimated PVFE Streams of Operative Vessels by Size



Source: Developed by Northern Economics using landings data from IATTC.

3 Assessment of the Cost of Overcapacity under the Status Quo

In this chapter the NEI Team examines the monetary cost of excess capacity in the EPO purse seine fishery. Since 2002 with the IATTC's approval of Resolution C-02-03 on the *Capacity of the Tuna Fleet Operating in the Eastern Pacific Ocean,* operative capacity in the EPO purse seine fleet has increased from ≈ 200,000 m^3 to ≈ 261,000 m^3 in 2016, an 1.7 percent annual rate of growth (see Figure 2 on page 7). Since 2013, however, operative capacity has grown at a much larger 5.6 percent annual rate.

Overcapacity in the EPO purse seine fleet and concerns about the continued sustainability of the BET and YFT stocks have led the IATTC to enact closure periods in the fishery. As summarized in the introduction of Chapter 2 (see page 8), closure periods were first enacted in 2002 with a fleetwide closure during the month of December. In 2003–2008, the closure period was expanded to 42 days, and in 2009 the closure period was expanded to 59 days. From 2010 to 2017, the closure period was set at 62 days, but in 2018 it was extended to 72 days.

The NEI Team notes that in addition to monetary costs, there are undoubtedly other negative consequences of excess capacity. These other consequences could include but are not limited to: 1) reductions in stock sizes and effects on catch rates; 2) impacts on processors and processing employees, and 3) impacts on fees charged by CPCs for each unit of capacity.

In the sections that follow costs of excess capacity are quantified from three perspectives:

1) What is the estimated cost, in terms of fleet-wide foregone net operating revenues (revenues minus estimated operating costs), of the 72-day closure period assuming vessels operate at recent levels? The costs will be estimated for the years 2014–2016.
2) What has been the estimated cost, in terms of fleet-wide foregone net operating revenues (revenues minus estimated operating costs), of the 62-day closure periods assuming vessels operate at recent levels? The costs will be estimated for the years 2014–2016.
3) What is the cost of excess capacity in terms of additional closure days that would be required to keep total harvests of BET and YFT at historical levels under a hypothetical situation in which all vessels expand their operations to sustainable maximum levels of effort and efficiency? This option was analyzed to portray the potential effects of vessels that were operational during the from 2007 to 2016. It does not capture the potential effects of vessels authorized to fish, but which were not operative (i.e. latent vessels, or the additional U.S. vessels authorized to take a single trip in the EPO), nor does it capture the potential impact of inactive/sunk vessels that are listed in the Register, but which are not currently authorized to participate. Finally, this analysis does not capture the potential effects of current vessels being replaced by more efficient vessels of the same size.

3.1 Methodology to Assess the Cost of Overcapacity under the Status Quo

This section describes the methodology that has been used to assess the cost of overcapacity in the purse seine tuna fishery.

The key component of this assessment is an evaluation of each vessel's operations in terms of operating days, with the goal of determining whether the vessel is operating at levels of efficiency and effort approaching a hypothetical **sustainable maximum operating days** (SMOD). Vessels that are operating at or near their SMOD will be deemed to be constrained by the 62-day closures under the status quo, and by the 72-day closures in the future. These vessels are likely to have been experiencing costs due to the overcapacity of the fleet. Vessels that are operating at levels that are well below their SMOD will be deemed unconstrained vessels that, under existing conditions, are unlikely to experience costs due to the overcapacity of the fleet. Whether or not a vessel is deemed by the NEI Team to have been constrained is based on a series of assumptions as follows:

1) All vessels will be required to take a minimum of 30 Shipyard days for annual maintenance.
2) Vessels are constrained by a closure if, after optimizing between trip shore days (BTSD), they could not have taken any additional trips unless the closures were not in place.
    a. "Optimization of BTSD" in this case means reducing their BTSD to be no longer than each vessel's average BTSD calculated after excluding shore periods that were longer than 35 days. BTSDs for FAD and Dolphin vessels under the Status Quo (SQ) are summarized in Figure 17–Figure 19 on page 24.
    b. In making the determination of whether one additional trip could be taken, the NEI Team assumed that the first or "incremental" trip of the vessel could be a short as the twentieth-percentile trip length taken by that vessel during the 10-years of data available. Similarly, the NEI Team assumed that the BTSD for this incremental trip could be as short as the twentieth-percentile BTSD for the vessel over the historical period.
3) Vessels that had "excess" BTSD, such that they could have taken at least one additional trip during the years after optimizing their BTSD, were deemed "Unconstrained" by the closure period.
4) All vessels that were considered constrained by the 62-day closures were also deemed to be constrained by the 72-closure period.
5) Vessels that were deemed unconstrained under the 62-day closure period under the status quo, but which were deemed as constrained by the 72-day closure, are assumed to forego an entire incremental trip (with trip length equal to its twentieth-percentile historic trip length).
6) Some vessels that historically have taken relatively long trips were determined to have been constrained even if there were no closure periods in effect. For these vessels, eliminating the closure period while still requiring a minimum of 30 days of shipyard time would not provide enough additional days for the vessel to squeeze in an incremental trip.
    a. For these vessels, it is assumed that under the 72-day closure they are likely to forego as many as 10 additional DAS, depending on the number of days they have available after optimizing their BTSD as described above.

We note here that we are assuming that vessels are unable to increase the amount of the harvest per trip because harvest per trip is physically limited by the hold size of the vessel, and the fact that vessels have no incentive to return to port before their holds are filled to capacity, or they hit their fuel constraint. We also note that we will be assuming that all vessels must continue to follow the IATTC regulations with respect to closure periods, and we will also assume that that they have a 30-day period each year for annual maintenance and shipyard work. In general, it is presumed that vessels will undertake their annual maintenance work coincidental to their closure period.

Finally, it is important to note that many vessels, particularly FAD vessels, operate both in the EPO and in the WCPO. The data provided for use by the IATTC include only sets made within the EPO and the resulting harvests. In addition, we have been provided data that show the number of days during each trip that the vessel was physically located within waters of the EPO. These data indicate that 47 percent of all trips taken from 2007 to 2016 included as least one day in which the vessel was not physically located in the EPO, and that during that same period approximately 18 percent of all DAS were spent outside of the EPO. The importance of non-EPO DAS is clearly seen in the data; therefore, this analysis will assume that any additions or reductions in the number of trips will preserve the relative number of EPO and non-EPO DAS.

Table 14 provides a summary of constrained vessels under the 72-day closure period, and also includes estimates on the number of vessels constrained under the 62-day closure periods in effect from 2010 to 2016. Finally, the table provides estimates of the number of vessels that would be at least partially constrained even if the closure periods were completely eliminated.[12]

Table 14. Summary of Vessels that are Constrained under the 72-day Closure Periods

	2010	2011	2012	2013	2014	2015	2016	Average
	Active Vessels that are or would be constrained with 72-day Closures							
Not Constrained	74	72	74	52	72	64	89	71
Constrained	127	131	134	151	146	162	148	143
	Percent of Active Vessels that are or would be constrained with 72-day Closures							
Not Constrained	37%	35%	36%	26%	33%	28%	38%	33%
Constrained	63%	65%	64%	74%	67%	72%	62%	67%
	Vessels that would be constrained with 72-day Closures, but are not with 62-day Closures							
Constrained	14	8	10	23	10	17	14	14
Percent of Total	7%	4%	5%	11%	5%	8%	6%	6%
	Vessels that Are Constrained if the Closure Periods were Eliminated							
Constrained	37	47	50	57	57	60	65	53
Percent of Total	18%	23%	24%	28%	26%	27%	27%	25%

3.2 Net Operating Revenue impacts of a 72-day closure.

Based on the methodology described above, the impacts on fleet-wide NOR of a 72-day closure have been estimated as shown in Table 15. From 2010 to 2016, the fleet-wide NOR averaged $310.8 million. The NEI team estimates the impact on NOR of the 62-day closures that occurred from 2010 to 2016 reduce fleet-wide NOR by an annual average of $36.6 million—an 11 percent reduction in fleetwide NOR. If 72-day closures had been imposed during the same years, the NEI team estimates that the annual average impact on NOR would have increased to $47.0 million—a 14 percent reduction in fleetwide NOR.

Table 15. Estimated Impact of Closure Periods on Fleet-wide Net Operating Revenues, 2010–2016

	2010	2011	2012	2013	2014	2015	2016	Average
	Revenues in $Millions of U.S. Dollars							
Estimated NOR if there were No Closures	$172.73	$358.02	$555.91	$572.47	$284.29	$159.50	$324.67	$346.80
NOR with 62-day Closures Under the SQ	$141.50	$314.25	$507.77	$524.77	$249.82	$135.20	$297.90	$310.17
Impact on NOR of the 62-day closures	($31.23)	($43.76)	($48.14)	($47.70)	($34.47)	($24.30)	($26.76)	($36.62)
Expected NOR if Closures were 72 Days	$134.76	$306.60	$495.70	$506.63	$243.09	$125.48	$286.06	$299.76

[12] This last group comprises vessels that have relatively high counts of DAS. One such vessel, for example, spent 297 DAS over 7 trips with average of 7 BTSD. The vessel's "active days" sum to 339 (297 DAS + 42 BTSD), leaving just 26 days for annual maintenance. Even if the closure period were eliminated, this vessel would not be able to take an additional trip during the year.

Impact on NOR of the 72-day closures	($37.97)	($51.42)	($60.20)	($65.84)	($41.20)	($34.01)	($38.61)	($47.04)

The results shown in Table 15 show estimates of monetary impacts of the closure periods. Since the closure periods are the result of excess capacity, the results also show the monetary impact of excess capacity. It is important to reiterate that these estimates are the product of a series of important and relatively conservative assumptions and about vessel behaviors—if alternative behavioral assumptions were made, the estimated monetary costs of excess capacity due to closure periods could be different.

One of the key assumptions is that vessels do not take marginal trips at the end of the year. For example, the NEI Team assumes that if 10 days are available to the vessel and that the vessel's average trip length is 40 days, the vessel is unlikely to make an additional trip, unless the vessel has taken multiple "short" trips during the historical record. This assumption is based on the idea that a shortened trip would not be profitable and therefore would not be made. If this assumption was relaxed, and it is assumed that vessels will utilize all days that become available with the elimination of the closure period, the estimates of the monetary cost of the closure period and excess capacity would have been higher.

Similarly, the NEI Team assumes that all vessels will undertake a 30-day maintenance period during each calendar year. If this assumption was relaxed—for example, to assume 45 days of maintenance is required every two years—then 15 additional fishing days could be available which would increase the estimated monetary impact of the closure period.

Finally, the NEI Team assumes that elimination of the closure period would not change the behavior of vessels with respect to the intensity of fishing effort (e.g. the number of sets made per day) or the number of Between Trip Shore Days (BTSD). It is possible to argue this should not be the case—Torres-Irineo (2015)[13] makes the argument that closure days cause vessel owners to intensify fishing effort resulting in more sets per day, and thus shorter trips, and shorter average BTSD. In fact, BTSD for Dolphin vessels have been declining (see Figure 16), but there is no significant trend for BTSD for FAD vessels. In addition, there have been no statistically significant trends for average trip lengths for either vessel type (see Figure 12), or for the number of average sets per day (see Figure 24).

If the NEI Team had assumed, like Torres-Irineo, that closure periods intensify fishing effort, then logically, the elimination of the closure periods would result in less intense fishing effort and therefore lower estimates of the monetary impact of closure periods.

3.3 Estimates of Changes in Net Operating Revenues and Necessary Closure Days Assuming all Vessels Operate at their Full Capacity

As a second approach to assessing the costs of excess capacity, the NEI Team has estimated the number of closure days that would be required if all vessels currently operational in the EPO increased their effective effort to sustainable maximum number of operating days (SMOD). It is assumed that vessels optimize their operations and their catch per year by minimizing their BTSD to be no longer than the vessel's average from 2007 to 2016, and then by taking advantage of the additional days made available by this optimization to make additional trips. In this case, we assume the BTSD for the last additional trip made by the vessel will be equal to its twentieth-percentile BTSD,[14] and all other BTSDs are equal to the

[13] This document is available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5226896/.

[14] The 20th percentile BTSD will almost certainly be shorter than the average BTSD for the vessel. The 20th percentile BTSD is calculated using all of the vessel's BTSD that were < 35 days. These BTSD are then sorted from low to high. The 20th percentile BTSD is the value below which 20 percent of the BTSD are found.

vessel's historic average. The NEI Team uses the 20th percentile BTSD because it assumed that the vessel operator will reduce its standard BTSD in order to make one last trip. Trip lengths are optimized to attain as many DAS as is possible while limiting the vessel's trip length to be less than or equal to the vessel's maximum trip length during the fishing year. It is also assumed that all vessels take a 30-day period for shipyard work. Finally, the NEI Team assumes that the catch per DAS during the additional trips equals each vessel's catch per DAS during the year.

It should be noted that while the NEI Team believes it is possible for vessels to increase effort up to their estimated SMOD as described above, the analysis is intended as a hypothetical exercise to demonstrate potential harvest levels that could occur with currently operative capacity.

Table 16 summarizes landings under the SQ and unconstrained landings during those same years if all vessels are operating at their SMOD. Overall, the NEI Team estimates that harvests could increase by approximately 31 percent over the status quo with some variation by species if not constrained by longer closure periods. Harvests of SKJ are estimated to increase by 38 percent on average, while harvests of BET and YFT are expected to increase by 28 percent and 21 percent, respectively. All these estimates are, of course, subject to change in the future due to, among other things, changes in stocks and changes in fishing technology.

The bottom portion of Table 16 shows the estimated closure periods for BET and YFT—calculated using the nominal daily catch rate[15] of the "maximized" fleet—that would keep the total landings of that species at or below landings under the SQ harvest. In 2010, for example, the IATTC would have had to extend the closure period by 33 days (from 62 to 95 days) in order to limit the "maximized fleet" to its 2010 harvest levels of YFT, or by up to 97 days to limit the maximized fleet to its 2010 harvest of BET. Similarly, the maximized fleet would have to have an 84-day closure to keep BET harvests at 2016 levels, or a 90-day closure to keep YFT harvests at 2016 levels.

If the IATTC is more concerned with stock levels of BET, it will set the closure period using BET harvest rate. Conversely, if IATTC is more concerned with YFT stock, the IATTC could use YFT harvests to guide its decision. If the IATTC wishes to be more conservative, they would set the closure period as the longer of the two estimates. In other words, they would use the BET harvest for closure periods during 2010 through 2015 but switch to YFT harvests to set the closure period for 2016.

[15] The nominal daily catch rate is calculated as the total catch divided by the number of calendar days available for fishing. Because we are assuming that all vessels must take a 30-day shipyard period each year, the number of calendar days available for fishing equals 335, or 336 in leap years.

Table 16. Landings by Species under the Status Quo, and if all Vessels are Optimized with No Closure Period

	2010	2011	2012	2013	2014	2015	2016
	Fleet-wide Catch(MT) Under the Status Quo						
All Species	473,604	552,066	554,714	558,591	571,969	646,159	646,344
BET, SKJ, and YFT	459,610	538,652	535,242	549,855	560,004	638,580	632,954
BET Only	51,471	47,897	55,877	53,965	55,320	67,642	61,713
SKJ Only	178,249	281,417	275,291	275,317	263,457	323,572	335,111
YFT Only	229,891	209,339	204,075	220,574	241,227	247,366	236,130
	Fleet-wide Catch(MT) if All Vessels Operated at Sustainable Maximum Level						
All Species	596,348	704,919	689,449	672,891	733,677	813,234	843,282
BET, SKJ, and YFT	578,620	688,450	665,234	662,245	718,219	802,130	816,028
BET Only	64,304	61,180	67,960	66,148	70,560	81,839	73,556
SKJ Only	228,557	370,996	353,309	332,822	342,939	422,030	455,229
YFT Only	285,758	256,275	243,964	263,276	304,721	298,261	287,243
	Closure Days Required to Bring Harvests Down to Status Quo Levels						
Use BET daily catch rates to determine closures	97	103	90	92	102	88	84
Use YFT daily catch rates to determine closures	95	91	85	84	100	87	90

3.4 Conclusions Regarding the Costs of Excess Capacity

There is little doubt that excess capacity is costing the EPO purse seine fleet. In the analysis above, the NEI Team estimates that the closure periods resulting from excess capacity have cost the fleet an average of 11 percent of their NOR since 2010—a total of over $256 million. The costs of the 72-day closure that is in place for 2018 are expected to be approximately 28 percent higher than the costs of the 62-day closures in place through 2016. The analysis also demonstrates that even if additional capacity does not enter the fleet, the existing capacity is significantly underutilized. If the current operative capacity expanded its effectiveness to "maximum" levels, closure periods would need to increase to an estimated average of 94 days—a 52 percent increase over the 62-day closure in place from 2010 to 2016.

There are also other costs of excess capacity that have not been quantified. These include 1) reductions in stock sizes; 2) impacts on catch rates; 3) impacts on processors; 4) impacts on fishing crew, processing employees and their families; and 5) impacts on fees charged by CPCs for each unit of capacity.

4 Analysis of Capacity Management Alternatives

Chapter 4 contains the assessment of alternatives to manage and reduce excess capacity in the EPO purse seine fishery. As discussed in Section 1 on page 2, the options analyzed were selected with the advice of the project's Advisory Committee which met in La Jolla, CA in October 2017 and refined in the development of the Inception Report delivered in December 2017.

The remainder of this chapter is divided into two subsections:

- **Section 4.2** provides a summary of the four capacity management approaches that are not necessarily mutually exclusive, and which could help set the stage for broader capacity reduction programs.
- **Section 4.3** provides an assessment of a harvest management program that could in theory eliminate closure periods, along with assessments of four capacity reduction programs that could lead to fewer vessels and capacity in the fishery.

4.1 Capacity Management Alternatives that will be Assessed Qualitatively

This section describes alternatives that the NEI Team will assess qualitatively. The following alternatives are included in this section:

1) Adoption of elements of Japan's proposal to the IATTC in 2013[16] that whenever there is a request to reassign capacity to a different vessel, some percentage of the capacity must be removed from the Regional Vessel Register.
2) Implementation of a "Small Steps" initiative discussed during the October Advisory Committee meetings. Collectively these small steps could set the stage for additional actions that could significantly reduce capacity.
3) A program that would freeze current latent capacity on the vessel register until fleet capacity is reduced to the optimum.
4) In addition to the qualitative assessment of specific alternatives listed above, the NEI Team developed a summary description of alternative ways that countries can benefit from the purse seine fishery without increasing fleet capacity.

4.1.1 Remove Capacity from the Vessel Register whenever there is a Request to Reassign Capacity to a Different Vessel

This is a proposal formally submitted by the Japanese delegation to the IATTC at its 85th Meeting in Veracruz, MX in 2013 as IATTC-85-Prop-H-2-JPN.[16] The proposal was further discussed at the Cartagena Workshop in 2014. Specifically, the following reduction rules would be assessed:

1) When an active purse seine vessel is replaced by a secondhand vessel, no more than 90 percent of the existing vessel's capacity shall be used;

[16] The full text of the proposal is available at http://www.iattc.org/Meetings/Meetings2013/Jun/_English/IATTC-85-PROP-H-2-JPN-Management-of-fishing-capacity.pdf.

2) When an active purse seine vessel is replaced by a newly built vessel, no more than 80 percent of the existing vessel's capacity shall be used;
3) When a purse seine vessel is newly introduced by activating inactive/available capacity, the actual capacity of the purse seine vessel shall be no more than 95 percent of the inactive/available capacity used.

This program will allow vessel replacements to continue but will force the owner of the replacement vessel to retire more capacity than the capacity they are bringing into the fishery. Assume, for example, that an owner wants to replace a vessel with 1,000 m^3 of capacity. If the replacement vessel is a new vessel, the new vessel could have capacity up to 800 m^3 without any additional requirements placed on the owner of the replacement vessel. However, if the new vessel has capacity greater 800 m^3, the owner of the new vessel will have to acquire and retire additional capacity in the fishery. Similarly, if the replacement vessel is a used vessel, the replacement vessel could be as large as 900 m^3 without the new owner having to retire additional capacity.

An unlimited number of other replacement scenarios are also possible. For example, both the new and the replaced vessel could have capacity of 1,000 m^3. In this case however, the new vessel owner would have to acquire and retire an additional 250 m^3 of capacity. In other words, the ratio of a replaced vessel to a **new** replacement vessel must be 100:80 or 1.25:1. Similarly, the ratio of a replaced vessel to a **used** replacement vessel must be 100:90 or 1.11:1. Finally if a sunk/inactive vessel from the Register is moved to an "authorized" status, the ratio of the sunk/inactive vessel to the replacement vessel must be 100:95 or 1.053:1.

The qualitative assessment for this program examines the historical data on replacement vessels in the IATTC Register and develops estimates of the number of years it would take to reach the IATTC target capacity level of 158,000 m^3, and alternatively 183,646 m^3—the average capacity level calculated under the assessment of Vessel Buyback that would potentially eliminate closure days assuming current vessel efficiencies (see Table 36 on 96). In addition, the NEI Team calculates the number of replacements per year that would be required to reach these same reduction goals in 25 years, assuming that the size of replaced vessels equal the size of average vessels in the current IATTC Register.

We note that the November 27, 2017 version of the IATTC Register had 271 vessels with an average capacity of 1,047.25 m^3 or 283,805 m^3 in total. Therefore, reducing capacity to 158,000 m^3 will require a reduction of 125,805 m^3, or a reduction of 100,159 m^3 to reach the average "No Closure" capacity estimated in the assessment of Vessel Buybacks in Section 4.2.1.

Table 17 shows counts of historical vessel replacements from the IATTC Vessel Register in terms of secondhand replacement vessels and new replacement vessels. The column labelled "Total Replaced Capacity" is the sum of replaced vessels estimated using the average capacity of vessels in the current Register (1,047.25 m^3/vessel). The rightmost column calculates the "Potential Capacity Reduction" that could have been realized had the proposed option been in effect at the time. Over the 15 years shown in the table, there were 120 vessel replacements—an average of 8 vessel replacements per year—with an estimated annual average replaced capacity of 8,378 m^3. Sixteen of the 120 replacement vessels were new and 104 of the replacement vessels were used. Using the reduction formula stated above, the vessel replacements shown in the table would have reduced the total Register capacity by 1,096 m^3/year or 17,532 m^3 over the 15-year period shown. At the historical rate of 1,096 m^3/year, it would take 115 years to attain the 158,000 m^3 goal, or 91 years to attain the 183,646 m^3 goal.

Table 17. Historical New and Secondhand Vessel Replacements, 2003–2017

Year	Secondhand Replacement Vessels	New Replacement Vessels	All Replacement Vessels	Total Estimated Replaced Capacity (m^3)	Potential Capacity Reduction (m^3)
2003	5	0	5	5,236	582
2004	5	0	5	5,236	582
2005	8	0	8	8,378	931
2006	1	2	3	3,142	640
2007	2	1	3	3,142	495
2008	4	0	4	4,189	465
2009	2	0	2	2,095	233
2010	6	1	7	7,331	960
2011	10	0	10	10,473	1,164
2012	5	0	5	5,236	582
2013	9	0	9	9,425	1,047
2014	18	8	26	27,229	4,189
2015	13	1	14	14,662	1,775
2016	8	3	11	11,520	1,716
2017	7	1	8	8,378	1,076
Average Year	**6.87**	**1.13**	**8.00**	**8,378**	**1,096**

Note: Assumes that all replaced vessels as well as all replacement vessels have capacity equal to the average capacity in the current IATTC Register (1,047.25 m^3).

Source: Developed by Northern Economics based on data supplied by the IATTC.

The NEI Team has also estimated the number of vessel replacements per year assuming the current average capacity per vessel that would be required to attain the two capacity reduction goals in 25 years. To reach the 183,648 m^3 goal in 25 years, an average of 36.6 vessel replacements/year totaling 38,291 m^3 (13 percent of current capacity) would need to occur. To reach the 158,000 m^3 goal in 25 years, annual replacements would need to average 45.9 vessels/year totaling 48,095 m^3 or 17 percent of current capacity.

The IATTC could consider modifications to the Japanese proposal to reach the IATTC optimum (158,000 m3) in less time at the same average capacity replacement of 8,378 m^3 per year (Table 17). For example, if the percentage of capacity to retire with each replacement is 40% for both new and used vessels, it is possible to reach the IATTC optimum of 158,000 m3 in 23 years. Please note that such a provision could also have the effect of reducing the rate of vessel replacement.

4.1.2 Multiple Small Measures that could Be Adopted in Association with Other Programs

As noted in Section 1 on page 2, this topic of a series of small steps was discussed during the Advisory Committee meeting, and it was noted that it may be relatively easy for the IATTC to approve these small measures. Many of these small steps are seen as precursors to other, larger policy changes that could result in larger capacity reductions. One of the primary criteria for inclusion as a “small-step” is that it will close existing loopholes and that it would be difficult for members to rationalize a dissenting opinion against the measure, given that the IATTC is on record to work toward capacity reduction and toward sustainable management of the EPO fishery.

Other measures that might have been included as a “small step” are not included because they are likely to require more lengthy deliberations. For example, “a program that would freeze current latent capacity on the vessel register until fleet capacity is reduced to the optimum" is not considered a part of the alternative because it could be considered controversial, particularly for countries which currently have latent capacity on the Register—the cited program is assessed separately in Section 4.1.3.

The following small steps would be assessed noting that the first three measures are directly related to capacity issues, while the final four measures could help facilitate more significant management measures in the future:

- Add a requirement that before countries replace lost vessels with newly-built vessels, they must document that existing vessels are unavailable;
- Add a requirement that U.S. vessels that are not on the IATTC register must provide to IATTC staff an application to fish in the EPO under their paragraph 12 exemption prior to the beginning of the fishing year;
- Tighten the rules regarding claims of hardship vis-à-vis the closure because of *force majeure*;
- Tighten definitions of set types with particular attention to definitions of NOA sets and OBJ sets;
- Require vessels that set on FADs to provide the IATTC at the beginning of each fishing year the number of FADs with which they are associated, and the information necessary to track all FADs via satellite. This will provide the IATTC a record of the number of FADs on the grounds and give the IATTC the ability to retrieve the FADs in the event that the vessel is lost.
- Implement a reduced form of an onboard electronic monitoring (EM) system—potentially including camera systems and possibly electronic logbooks;
- Make changes to the onboard observer program to align with improved set-type definitions and use of onboard monitoring systems;
- Increase numbers of shore-side plant inspectors to ensure that every offload is monitored, and that catch samplings of landings from every offload are undertaken, with timely reporting of sample data;

4.1.2.1 Small Steps That Could Directly Affect Capacity in the EPO Purse Seine Fishery

<u>Require that before countries replace lost vessels with newly-built vessels, they must document that existing vessels are unavailable as a replacement</u>

Currently under paragraph 11 of IATTC Resolution C-02-03, the four countries listed in paragraph 10.1 of IATTC Resolution C-02-03 (Costa Rica, El Salvador, Nicaragua, and Peru) are required to:

> …notify the other participants, through the Director, and (2) undertake efforts to find a suitable vessel from the Register for at least four months following such notification before bringing a new vessel in the EPO.

This small step would expand that requirement to all countries that are wishing to replace a lost vessel, and it is possible that expanding this requirement to all CPCs could slow down the replacement of vessels that have been lost, and if used vessels are found, it could potentially slow the technological expansion of capacity that is more likely with new vessels than old vessels.

Table 18. Number of Vessel Sinkings in the EPO, 2000–2017

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of Vessels	3	2	6	2	4	0	0	2	2	4	4	0	0	2	0	0	2	0

Source: Developed by NEI based on data provided by IATTC staff.

The NEI Team notes that it is possible to conceive of ways to circumvent these rules. For example, since there are no prohibitions against the replacement of an existing vessel with a new vessel, the owner of the rights to a sunk vessel could form a temporary partnership with the owner of an existing vessel with the same or similar capacity as the sunk vessel. The owner of the existing vessel would temporarily transfer ownership of the existing vessel to the owner of the sunk vessel. The owner of the sunk vessel would then claim the existing vessel is replacing the sunk vessel, while the owner of the existing vessel would "replace" it with the "new" vessel. The two owners would than swap ownership documents and the owner of the sunk vessel would have a new vessel, and his former partner would once again own the original operative vessel.

The paragraph above highlights one of the downsides of the proposal—specifically that there is nothing within IATTC resolutions that requires vessel owners wishing to replace an existing operative vessel to first search for a suitable used vessel and document that none are available before a new vessel can be used as a replacement. As shown in Table 17 on page 63, there have been 120 vessel replacements since 2003, and 16 of these replacements have been with new vessels.

Require U.S. vessels to report their intentions to IATTC staff if they plan to operate in the EPO under Paragraph 12 of C-02-03

This small step will add a requirement that in order for a U.S. vessel to operate in the EPO under Paragraph 12 of C-02-03, it must have filed a notification of its intent to operate with IATTC staff prior to the beginning of the upcoming fishing year. Vessels which have not notified IATTC staff prior to January 1 would not be eligible to participate in the EPO during that year.

In theory, the notification of the intent to operate will provide IATTC staff with additional information regarding the likely capacity of the fleet that will operate in the EPO. The additional information could potentially allow them to recommend further actions that could help maintain the sustainability of stocks.

If in fact, all the U.S. vessels that file their intent to operate actually do fish in the EPO, then prior notification could be an aid to IATTC staff. However, because there are no repercussions for vessels that file but do not participate in the EPO, it is likely that all eligible vessels will file a notification every year. By filing, the vessels are able to maintain their option to participate, and that option is valuable in the event that unforeseen events transpire in the WCPO.

Thus, unless the IATTC can craft meaningful repercussions for vessels that file but don't participate, the notification system is unlikely to provide any real benefits.

Tighten the rules regarding claims of hardship vis-à-vis the closure because of *force majeure*;

Currently vessels can apply for a *Force Majeure* exemption that reduces the closure period to 40 days. This option would tighten the criteria for claiming a *Force Majeure* exemption. The language regarding *Force Majeure* exemptions is found in in paragraph 6 of Resolution C-17-02.[17]

The IATTC staff have provided information summarized in Table 19 regarding the number of vessels by country that have been granted closure period exemptions by year. The number of *Force Majeure* exemption requests has increased every year since 2013. The NEI Team notes that four vessels have been granted multiple exemptions during the period shown with one vessel receiving three exemptions.

Table 19. *Force Majeure* Exemptions Granted by Country of Applicant, 2013–2017

Applicant	2013	2014	2015	2016	2017	Total
Columbia	0	1	0	0	2	**3**
Ecuador	1	2	1	3	9	**16**
Mexico	0	0	2	0	1	**3**
Nicaragua	2	0	0	4	0	**6**
Panama	1	0	0	0	2	**3**
U.S.	0	0	1	0	2	**3**
Venezuela	0	2	2	3	0	**7**
All Countries	**4**	**5**	**6**	**10**	**16**	**41**

Source: Developed by NEI based on data provided by IATTC staff.

The NEI Team notes that the *Force Majeure* exemption language which is excerpted below, protects the confidentiality of the vessel (paragraph 6c). The NEI Team also notes that the exemption will be granted unless there is stated objection to the request (paragraph 6d):

6. a. *Notwithstanding the provisions of subparagraphs 5a and 5b, a request by a CPC, on behalf of any of its vessels, for an exemption due to force majeure*[18] *rendering said vessel unable to proceed to sea outside said closure period during a period of at least 75 continuous days, shall be sent to the Secretariat, at the latest one month after it happens.*

   b. *In addition to the request for an exemption, the CPC shall send the evidence necessary to demonstrate that the vessel did not proceed to sea and that the facts on which the request for exemption is based were due to force majeure.*

   c. *The Director shall immediately send the request and the evidence electronically to the other CPCs for their consideration, duly coded in order to maintain the anonymity of the name, flag and owner of the vessel.*

   d. *The request shall be considered accepted, unless an IATTC Member objects to it formally within 15 calendar days of the receipt of said request, in which case the Director shall immediately notify all CPCs of the objection.*

[17] www.iattc.org/PDFFiles/Resolutions/_English/C-17-02-Tuna-conservation-in-the-EPO-2018-2020-and-amendment-to-Res.-C-17-01.pdf

[18] For the purposes of paragraph 6, only cases of vessels disabled in the course of fishing operations by mechanical and/or structural failure, fire or explosion, shall be considered force majeure.

e. *If the request for exemption is accepted:*

   i. *the vessel shall observe a reduced closure period of 40 consecutive days in the same year during which the force majeure event occurred, in one of the two periods prescribed in paragraph 3, to be immediately notified to the Director by the CPC, or*

   ii. *in the event said vessel has already observed a closure period prescribed in paragraph 3 in the same year during which the force majeure event occurred, it shall observe a reduced closure period of 40 consecutive days the following year, in one of the two periods prescribed in paragraph 3, to be notified to the Director by the CPC no later than 15 July.*

   iii. *vessels that benefit from the exemption must carry an observer aboard authorized pursuant to the AIDCP (Agreement on the International Dolphin Conservation Programme)*

After reviewing the language in paragraph 6, and having reviewed the IATTC data regarding *Force Majeure* exemptions that have been granted, the NEI Team would recommend three potential changes:

1) If a vessel has made a request or has been granted a *Force Majeure* exemption in the past, the request notification provided by the Director should be required to include the specifics (within confidentiality guidelines) for previous requests and exemptions. For example, the Director could say: “This vessel was granted an exemption in 2014.”
2) Tighten the language defining *Force Majeure* by adding a sentence to the end of the footnote in paragraph 6a as follows: “The *Force Majeure* exemption is not to be used in the event of mis-management of vessel or dereliction of standard protocols for vessel maintenance.”
3) Add a sentence at the end of paragraph 6b as follows: “The documentation must include signed affidavits stating that the vessel was in the shipyard for annual maintenance within 400 days of the *Force Majeure* event.”

4.1.2.2 Small Steps that Could Help Facilitate More Significant Management Measures

Tightening Definitions of FAD and Unassociated set types

In the event that the IATTC wishes to implement measures on a set-type basis, the IATTC could create robust definitions for each set type. There are currently no standard definitions for set types approved by the IATTC.

The lack of definitions in regulation means that reporting of set types may be quite subjective. If, for example the IATTC approves a rule based on set types, the vessel operator will have a very real incentive to report what would normally be considered an OBJ or DEL set as an NOA set. The fact that there is nothing in regulations defining set types means there may be considerable leeway in reporting a given set as an OBJ set or as an NOA set.

Assume, for example, that there is a FAD very close to a fishing vessel. If the purse seine completely surrounds the FAD, then it would be quite difficult to report the set as an NOA set. However, if the purse seine is set on only one side of the FAD, then there would be some room to legitimately report the set as an NOA set.

The NEI Team suggests that the definition of an OBJ set include language such as: “Any set that takes place within *DDD* meters from a FAD or other floating object is considered to be an OBJ set” where *DDD* is a “pre-determined distance” that both the observer and the skipper could easily and reliably estimate. IATTC staff report that there have been discussions regarding an appropriate distance from a FAD for a set to qualify as an OBJ—suggested distances have range widely.

As a practical measure, the NEI Team notes that if FADs or other floating objects have a surface that protrudes above the water level, then it is very possible that observers could ascertain the distance with a simple laser rangefinder such as used in hunting or in golf. These inexpensive rangefinders (which can be obtained for $200 or less) will typically be able to measure distances accurately out to at least 500 meters. Similarly, automated camera systems mounted on the vessel could also determine the distance between the vessel and floating objects—such systems could eliminate potential inaccuracies and disagreements that might arise with hand-held rangefinders.

Dolphin (DEL) sets could be defined as any set in which Dolphins are present within a pre-determined distance during the setting of purse seine. Again, the use of laser range finders would be an asset.

Unassociated (NOA) sets would be defined as any set that is not a OBJ set and is not a DEL set.

Require vessels that set on FADs to provide appropriate documentation to the IATTC

This step would require vessels that set on FADs to provide the IATTC at the beginning of each fishing year the number of FADs with which they are associated, along with the information necessary to track all FADs via satellite. This will provide the IATTC a record of the number of FADs on the grounds and gives the IATTC the ability to retrieve the FADs in the event that the vessel is lost.

The information would provide the IATTC a valuable tool to enhance assessment of the impact of fishing on FADs. Additionally, because FADs aggregate fish regardless of whether a vessel is tending the FAD, the measure provides IATTC the means to locate and retrieve FADs that are abandoned.

Implementation of onboard electronic monitoring;

The implementation of selected components of an electronic monitoring system may be considered a small step that could potentially be approved by the IATTC. Examples of components that might be considered part of "small step" program include:

1) Installation of camera systems to differentiate between OBJ sets and NOA sets;
2) Installation of camera systems to monitor discards—this would complement an IVQ system or a Small Tuna Vessel Limit program (options that are discussed later in this report), both of which could increase incentives for discarding.
3) Implementation of an electronic reporting system that would transmit logbook and observer data electronically on a weekly or even daily basis;

In addition to these three elements, this section provided an overview of a more complete study on electronic monitoring systems for the purse seine fisheries in the EPO.

Camera systems to differentiate between OBJ sets and NOA sets

A camera system mounted above the deck of the vessels that is capable of being manipulated to focus on particular objects some distance away from the vessel could in theory be used to help differentiate between NOA sets and OBJ sets. It is assumed that the system would be used in conjunction with an on-board observer. The following is a hypothetical example of how the system could work and assumes there is a requirement for the vessel operator to document that there is no "floating object" in the "vicinity" when they are conducting an "NOA" set. The following steps could be required:

1) The operator would declare that the ongoing set is a NOA set, by making an entry in its logbook.

2) The observer would then scan the surrounding area documenting any floating objects in the vicinity of the vessel.
3) The operator would also activate the camera, which would be programmed to take a 360° scan of the waters surrounding the vessel.
    a. If the camera detects one or more floating objects, the camera would be programmed to measure and record the distance between the camera and the object(s).
4) The video record could then be stored to document the set.
5) If there is a discrepancy between the observer and vessel operator's logbook document of the set type, then the video evidence could be reviewed.

Camera systems to monitor discards

A similar camera mounted system could be used to monitor discards. The system would be designed so that a view of the entire deck is captured digitally. The camera system would be specifically programmed to monitor discarding activity. Bucaram (2017) conducted a financial analysis of the implementation of this system in the entire purse seine fleet that operates in the EPO, under the assumption that the EM system, if installed on a vessel, would also require the vessel to carry an observer.

Implementation of electronic logbook and observer reporting systems

Real-time electronic reporting systems for logbook and observer reports have been implemented in other fisheries around the world. For example, the National Marine Fisheries Service—Alaska Region utilizes its eLandings[19] reporting system that collects vessel operator logbook data and observer reports on a daily basis.

Implementation of an electronic reporting system can significantly enhance fishery management when real-time data are needed to effectively implement the management regime that has evolved in a particular fishery or region. In Alaska, a fishery management system involving annual catch limits, individual vessel quotas, sector quotas, processor limits, and prohibited species limits all led to the need for real-time monitoring of catch and effort as well as buying and processing activities of buyers and processing facilities. If real-time data are less important, then moving toward an electronic reporting system may not be warranted.

In Alaska, the full migration to the eLandings system involved state, federal, and international fishery management agencies and a complete overhaul of the paper-based fishery reporting system. While the eLandings System is overwhelmingly seen as a significant improvement, the transition to the system was costly, and took many years to accomplish.

A more modest system could undoubtedly be developed to meet the needs of the EPO purse seine fishery even if it were to transition to an IVQ-based system. Such a system could that build from the current observer and logbook reporting systems.

Implementation of Full EM System

The discussion that follows provides a high-level summary of a more complete Electronic Monitoring (EM) System.

The implementation of a complete EM system for the purse seine fleet that operates in the EPO can be considered as a parallel program to the capacity reduction alternatives proposed in this report in the absence of an observer. An EM system can improve the collection of information regarding the fishing

[19] For additional details on the Alaska Region eLandings program see https://alaskafisheries.noaa.gov/fisheries/electronic-reporting and the report by Northern Economics on the elandings system at http://www.adfg.alaska.gov/static/license/fishing/ pdfs/2015_final_elandings_cost_benefit.pdf.

operation of the purse seine fleet in the EPO. This system could also improve the monitoring and documenting of discard and set type through video evidence. Bucaram (2017) conducted a financial analysis of the implementation of this system in the entire purse seine fleet that operates in the EPO, under the assumption that the EM system, if installed on a vessel, would eliminate the need for the vessel to carry an observer.

Bucaram (2017) also listed several conditions that should be considered during the implementation, from which we highlight the following:

1) Every element of the system to be implemented in the "no-observer" fleet will be more complex and costly compared to the case when there is an observer present. As a starter, it is important to determine if buy-in from the boat owners can be achieved. If the level of cooperation from this group is low, EM could fail. The program design needs to incorporate both outreach and a very detailed program specification, which includes EM system obligations and onboard catch handling protocols. Data analysis is much more complex because the important activities to watch occur at multiple cameras. The analysis group needs to have a tight feedback loop with fleets to respond to problems and help improve data quality.
2) It is imperative to be conscious about the current state of the technology, since this will limit what is possible from a technical point of view. Technology is constantly being improved; however, the strategy that is recommended is to build a program based on feasible options now and evolve the program as technology becomes available, rather than delay implementation. For example, the weaknesses of an EM system will be around catch composition, both at the level of major target species (i.e. bigeye/skipjack) and at the level of minor bycatch species. With respect to the former, if the tuna species are mixed in brails, there will need to be some control point where the composition can be distinguished. With the minor bycatch species, Archipelago's experience showed that these are removed at several points along the way, so enumeration at any point would be incomplete. Both these issues speak to a need for more clearly defined catch handling protocols, which are best done in collaboration with vessel crews.

An EM system that is carefully implemented could be an excellent complement to the observer program which could improve the collection of information in the fishery and could increase the feasibility of new management policies such as an IVQ system.

Finally, it is necessary to specify that an EM system is not a substitute for but a complement to the observer program. In spites of this, Bucaram (2017) proposes the implementation of a standalone EM system on boats that do not carry observers. He states that this is an improvement from their current reporting process that is based on logbooks (i.e. self-reporting). For boats that carry observers, Bucaram (2017) asserts that an EM system is a complement that will enhance the reliability of the information provided by observers.

Change the onboard observer program to align with improved set-type definitions and use of on-board monitoring systems

If the IATTC changes definitions of OBJ and NOA sets, there may be monitoring issues that could benefit from an expanded authorization for observer reporting. For example, observers could now be required to make a judgement on the set type. The additional scope of work for observers will clearly depend on the set type definitions developed.

Even if the IATTC does not make changes to set definitions, there may be changes/additions to observer work protocols that can be implemented in the next few years that will make it easier to adopt programs that will require expanded observer duties.

If the IATTC wishes to move to a system that limits total catch on a species-by-species basis, either fleet-wide, by sector, or for individual vessels, then observers become important deterrents against misreporting. This is particularly true for discards of fish. If a system is implemented that limits the total amount of catch of a particular species, or of smaller or larger fish within a species, then there will be incentives to discard fish, particularly if the limiting species is not as valuable as another component of the catch.

For example, if Small BET become a limiting factor for individual vessels or for the fleet as a whole, there will be an incentive for vessels to underreport Small BET. The incentive to underreport leads to discarding of fish that previously would have been kept on board. While a dead fish is a dead fish, an unreported dead fish does not easily make its way into the biological calculus for stock management.

Enhance the shore-side plant inspector program

Given proposals to limits harvests of individual vessels either through an individual vessel quota (IVQ) system, or through annual vessel limits on the catch of particular species or a subset of that species (e.g. an annual vessel limit on Small BET), the IATTC will need to have the means to accurately monitor catch of all individual vessels. Within the current monitoring infrastructure, it appears that the plant inspector program is the best candidate to morph into an Individual Vessel Landings Monitoring System.

Currently the IATTC relies on a combination of data collection programs to generate estimates of total catch, species composition, and size composition within species.

Vessel Logbooks: Each vessel maintains and submits vessel logbooks that report the vessel's fishing effort and provide the vessel operator's best estimate of catch by species. The vessel logbook data may currently be very accurate with respect to catches of tropical tuna. One reason for their current level of accuracy is that there is no incentive to misreport catch. If the management system changes to one in which catch is a limiting factor either collectively or individually, then there will be incentives to misreport catch, particularly of constraining species.

Observer Data: Observers provide data on catch and effort similar to that provided in the logbooks. However, unless the observer is actively monitoring the freezing process below-decks, it is unlikely that observer hail-weight estimates will be accurate enough on a species-by-species basis, particularly when smaller tuna are being harvested.

Plant Inspector Data: It is the NEI Team's understanding that the plant inspector program is implemented at the country level rather than by IATTC regulation. IATTC staff have indicated that Marine Fauna Reports (MFRs) generated by plant inspectors—see Section 2.1.2.2 on page 31—are their best source of information for species composition within landings data, and their only reliable source for estimated size composition by species.

If the IATTC wishes to manage landings by species or by species and size on an individual vessel basis, then it appears there will need to be enhancement to the Plant Inspector Program. If the IATTC does not need to monitor landings at the individual vessel level, then the need for improvements to the program are less clear. Assuming the former, the NEI Team believes the following would be required:

- Increase the numbers of plant inspectors to ensure that every offload is monitored and that statistically valid MFRs are generated along with estimates of total catch by species.
- Ensure that MFRs and total catch reports are provided to IATTC in a timely basis, preferably before the vessel departs on its next trip. This could be undertaken through the use of electronic catch documentation applications that provide real time data.

4.1.3 Freeze Current Latent Capacity on the Register until Fleet Capacity is Reduced

This option would freeze latent capacity on the register until fleet capacity is reduced to an optimal level. This option was not considered as part of the “small steps” initiative described above, because it was believed to be potentially controversial, and therefore less likely to be approved by the IATTC.

There are three types of “latent” capacity on the IATTC Vessel Register. Two of these—"inactive” vessels and “sunk” vessels—were described in the discussion regarding Figure 2 on page 7 and again in Section 2.1.1.1 on page 19. A third type of “latent” capacity is vessels that are “authorized” (i.e. listed in the Register without a designation of “Inactive” or “Sunk”), but which during any given year are not actively fishing (i.e. operative). For purposes of this analysis, the NEI team will call these vessels “Authorized/Latent” vessels. There are also other types of latent capacity:

- The vessels that were deemed “unconstrained” in the assessment of the cost of overcapacity could be considered latent capacity—these vessels could increase the intensity of their operations as described in Section 3.3 and force increases in the number of closure days required to maintain stocks at sustainable levels.
- U.S. flagged vessels that are not listed in the IATTC Register, but which are permitted to fish as purse seiners in the WCPO, can also be considered as “latent”. Paragraph 12 of IATTC Resolution C-02-03, authorizes up to 32 U.S. vessels to take one 90-day trip within the EPO each year. There are currently 21 U.S. vessels in the WCPFC Registry that are not also on the IATTC Registry with a total capacity of 33,337 m^3. In theory, these vessels all could participate in the EPO, effectively adding another 8,334 m^3 (25% of 33,337 m^3).

Table 20 shows the number of such “paragraph 12” vessels and trips since 2002. Vessels which have not been taking advantage of the exemption are considered to be latent vessels because they are not fishing even though they are technically authorized to fish.

Table 20. Number of Unregistered U.S. Vessels Taking Trips in the EPO under Paragraph 12 of C-02-03

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Vessel Count	4	1	2	0	0	0	0	0	0	0	1	0	0	5	2	1

Source: Developed by Northern Economics based on data provided by the IATTC.

Currently (as of November 27, 2017) the IATTC Vessel Register lists 284 purse seine vessels in total (see Table 21), 13 of which are listed as sunk or inactive—vessels in these two latent categories have a total capacity of 5,697 m^3. Table 21 also provides a comparison to vessel counts and hold capacity from the actual fishery data for 2016 provided by the IATTC for this analysis. The 2016 fishery had a total operating capacity that was 23,132 m^3 less than the authorized capacity in the Register.

The qualitative assessment examines each of the three categories of Register Capacity that were not operating in 2016. The assessment also qualitatively examines the issue of capacity reduction goals and describe potential circumstances under which the freeze can be dropped. An example of the latter could be the successful implementation of a Transferable IVQ program.

Table 21. Current Purse Seine Register Status with a Comparison to Operating Capacity in 2016

Current Register Status	Vessel Count	Hold Capacity (m³)
Current Inactive/Sunk Capacity	13	5,697
Eligible U.S, "paragraph 12" vessels	21	8,334
Current Authorized Capacity in the IATTC Register	271	283,805
Current Register and "Paragraph 12" Total	**305**	**297,836**
2016 Actual Operative Capacity (includes 2 active paragraph 12 vessels)	237	260,673
Current Register and 'Paragraph 12" Total in Excess of 2016 Actual Operating Capacity		37,163

Source: Developed by Northern Economics, Inc. based on data provided by IATTC.

There is no doubt that freezing officially latent capacity on the Register will be a benefit to vessels that are currently operative. However, allowing these vessels to become operative after capacity has been reduced appears to be counterproductive. Assume, for example, that a vessel buyback program is approved and implemented at a cost of $200 million, and the program successfully removes capacity to a level that eliminates closure periods. If the now latent capacity is then allowed to re-enter the fishery, then the vessel buyback program immediately fails and once again the fleet has too much operative capacity and harvests will exceed sustainable levels.

If on the other hand a transferable IVQ program were approved and implemented, the freeze on latent capacity could be dropped without negative repercussions. This is because the issue of capacity is internalized in a market-based system such an IVQ—a decision by one owner to add capacity will have little or no effect on the ability of other vessel owners to participate profitably in the fishery.

4.1.4 A Description of Alternatives Ways Countries Can Benefit from the Fishery without Increasing Fleet Capacity

There are different mechanisms through which countries can benefit from the tuna fishery without developing fleets. For instance, capacity claims could be satisfied through leasing or transfer mechanisms from companies/vessel owners in other countries. In the last few years, authorized capacity has increased, there is more capacity on the market, and the lease value of that capacity has decreased, which makes it more profitable for operators to lease instead of purchasing capacity. This price dynamic can be used as a starting point for establishing policies that both reduce fishing capacity (to protect the fish stocks covered by the Convention) and protect the sovereign rights of coastal States to have access to marine resources in their EEZ and high seas.

Consequently, a policy through which both objectives can be accomplished without producing an increase in fishing capacity is the establishment of a system of capacity transfer. It is necessary to clarify that a capacity transfer system is a broader concept than, for example, the physical transfer of vessels. The goal of a capacity transfer system is economic development in developing coastal States. Options for capacity transfers that provide real economic and social benefits to developing coastal States in the tropical tuna fishing sector or other sectors include:

- Reflagging or importing vessels
- Access fees
- Joint ventures
- Crewing/observers

- Charters or other arrangements
- Investment in local processing/shore-side services or local fleets
- Transshipment related activities
- New processing plants or cold storage facilities, etc.
- Education, training and skills transfer (training in science, fisheries management, technology, operations, enterprise management)
- Market access
- Transfer of technology
- Home-porting and local-basing of vessels and/or companies

Any of these capacity transfers of fishing opportunities should be consistent with established management objectives of Regional Fishery Management Organizations such as the IATTC. In addition, and more importantly, capacity transfers should occur in a manner that does not result in a net increase in the purse seine fleet in the EPO. Thus, these mechanisms can be a feasible alternative to satisfy the claims of coastal States without compromising any capacity reduction program, and above all without affecting the sovereign rights of those countries.

The impacts of these policies will not be analyzed here, but it is assumed that they will be considered in conjunction with capacity reduction policies. This could prevent increases in capacity due to the claims of the countries that believe they do not have sufficient active capacity currently.

4.2 Capacity Management Alternatives that will be Assessed Quantitatively

This section describes alternatives that the NEI Team will assess quantitatively as follows:

1) A Vessel/Capacity Buyback Program
2) IATTC Member States Reduce Operative Capacity by 10 Percent per Year and Freeze that Capacity until total Capacity reaches optimum level
3) Voluntary Capacity Reduction Pilot Programs
4) A Transferable Individual Vessel Quota Program
5) Annual Small Tuna Vessel Limits for BET and YFT

We also describe the major analytical assumptions that will be used in the analyses as well as assessment methodologies. The assessments of capacity management alternatives all attempt to quantify the impact of the alternative on closure days. Closure days are currently the primary means by which operative capacity is curtailed to maintain harvests at sustainable levels.

Impacts on Closure Days

The discussion that follows summarizes the methodology used by the NEI Team to estimate the impact on closure days of the various alternatives. This methodology recognizes that the catch per day of the fleet after a buyback (for example) will be less than the catch per day of the original fleet (10 vessels will catch less than 20 vessels). After the buyback, the remaining fleet will have access to the harvests that were foregone by the vessels that were bought out and presumably additional days in which to catch those fish. The remaining fleet is presumed to catch the foregone harvest at its (the remaining fleet's) historical average rate of catch per day, which is defined mathematically in Equation one:

$$ACDRF_s^{hist} = CRF_s^{hist} \div D^{hist} \quad (1)$$

Where the future closure period is estimated in equation two as:

$$FCP_s^y = CLP_s^y - \left[FGC_s^{hist} \div ACDRF_s^{hist})\right]; \text{ such that } \left[FGC_s^{hist} \div ACDRF_s^{hist})\right] \leq CLP_s^y \quad (2)$$

and where

$ACDRF$ = Historical[20] average catch per day of the remaining fleet for species s;

CRF = Historical[20] average catch of the remaining fleet remaining fleet for species s;

D^{hist} = Historical[20] average of potential fishing days, which is equal to the number of calendar days in the year reduced the closure period, i.e. 303.33 since 2016 was a leap year.

FCP = The future annual closure period, in days, in year y for species s, where s can take on values of bigeye tuna BET, yellowfin tuna YFT, or skipjack tuna SKJ;

CLP = The reference closure period, in days, for species s in year y[21];

FGC = Average foregone catch in metric tons (MT) of harvest of bought-out vessels of species s over the last three years.

Equation three lays out an example calculation of a closure period in a future year (2019) for BET based on the 2016 fishing year which had a 62-day closure period:

$$FCP_{BET}^{2019} = CLP_{BET}^{2016} - \left[FGC_{BET}^{2016} \div ACDRF_{BET}^{hist})\right] \text{ so that } \left[FGC_{BET}^{2016} \div ACDRF_{BET}^{hist})\right] \leq CLP_{BET}^{2016} \quad (3)$$

If we hypothetically assume that the bought-out vessels had an historical average of 6,000 mt of BET, and that the remaining fleet has an historical average BET catch per day of 197.37 mt/day then:

$$FCP_{BET}^{2019} = 62 - [6{,}000 \div 197.37]; \text{ such that } [6{,}000 \div 197.37] \leq 62 \quad (4)$$

$$FCP_{BET}^{2019} = 62 - 30.4 \quad (5)$$

$$FCP_{BET}^{2019} = 31.6 \text{ or } 32 \text{ days} \quad (6)$$

It is important to note that a reduction in closure days cannot exceed the number of closure days.

Calculation of the FCPs is complicated by the fact that the IATTC is carefully monitoring two stocks—BET and YFT. Because different vessels have different propensities to harvest the two species, it is very possible a buyback that results in a 32-day FCP based on BET harvests might only require (for example) a 25-day FCP based on the foregone catch of YFT and the remaining fleet's catch of YFT. If the bought-out vessels focused primarily on YFT and the remining fleet focuses more on BET, then the $FCPs$ calculated using YFT as the basis will be shorter (i.e. less restrictive) than the $FCPs$ calculated using BET.

Assuming the scenario above holds—i.e. a 32-day FCP based on BET harvests, but a 25-day FCP based on YFT harvests—the NEI Team assumes that the IATTC will use the longer of the two FCPs because it will more likely assure that harvests of both BET and YFT remain below the acceptable harvest levels.

The NEI Team notes that it is possible that catch per day for the remaining fleet will increase as a result of capacity reduction programs. For example, if there are fewer FAD vessels and the number of deployed FADs remains the same, then each remaining FAD vessel will have access to a greater number of FADs. This could result in increases in catch per day for FAD vessels. Similar concerns could potentially be made with respect to Dolphin vessels.

[20] The NEI Team will calculate catch per day using the last three years of data (2014–2016).

[21] Since 2010 closure periods have been 62 days.

It is also possible that vessels in the remaining fleet could increase the intensity of their effort. If there are additional fees associated with the capacity reduction programs, there would be additional financial incentive to reduce BTSD and increase the number of sets per day. In any case, the quantitative assessments that follow do not take into account the potential that catch per day for the remaining fleet could increase.

4.2.1 Assessment of Potential Impacts of a Vessel/Capacity Buyback Program

This section contains the assessment of the impacts of a fleet-wide Vessel/Capacity Buyback Program. The assessment assumes that the Buyback Program would be set up with the approval of the IATTC and cooperative member countries (CPCs), such that capacity would be permanently removed from the IATTC register.[22]

For purposes of this assessment, the NEI Team presumes that the Buyback Program will operate as follows:

1) The IATTC, CPCs, and vessel owners will agree that a Buyback Program is necessary to manage the fishery in a sustainable manner.
2) A Buyback Authority will be established.
3) Funding for the Buyback Program will be secured by the Buyback Authority as some combination of loans and grants.
4) The Buyback Authority will publish a notice that indicates the amount of funding that has been secured along with rules under which bids will be accepted and the protocols/criteria by which bids be judged and awarded. The NEI Team presumes in general that bids will be ranked as in a reverse auction in which the lower bids will be accepted before higher bids until all available funding has been allocated.
5) Vessel owners will work with their National Fishery Organizations to determine the minimum amount they would mutually be willing to accept as compensation to permanently remove the capacity from the IATTC Register and that the vessel itself would be permanently banned from the IATTC Register and from participating in the EPO. We note here that it is presumed that the vessel itself would continue to be owned by the vessel owner and that the vessel owner could continue to use the vessel in other fisheries outside the EPO to which it has access, such as the WCPO purse seine fishery.[23]
6) Vessel owners will submit binding bids to the Buyback Authority. Valid bids will be certified not only by the vessel owner, but also by the vessel's National Fishery Organization.
7) The Buyback Authority will rank and sort the bids and provide a notice to individual bidders whether or not their bids have been tentatively accepted. The overall result of the process will also be made public. Included in this notification will be the total cost of the buyback, the annual

[22] There are a wide variety of ways to construct vessel buyback programs, and the specific program described here should be considered as a demonstration of potential impacts. The NEI Team also notes that buyback are often combined with other right-based programs such as IVQs—in this analysis we examine a vessel buyback as a stand-alone option for reducing capacity. Finally, we note that country-specific buyback programs in the EPO are discussed separately in Section 4.2.3.

[23] Vessel buyback programs often require that the vessel be scrapped if it is bought out the fishery. Because the data available to the NEI Team does not include information regarding effort, landings, and revenue that vessels may have made in the WCPO, we have chosen to limit this particular assessment to a buyback of the right for the vessel to participate in EPO fisheries. The NEI Team believes that a program that actually requires scrapping the vessel should only be assessed if all of the information regarding fishery activities are available to the analysts.

debt service that will be required, and the estimated annual payment that each remaining vessel will be expected to make, and documentation from the IATTC staff regarding their estimate of the resulting reduction in the number of closure days they would recommend.

8) The NEI Team presumes that the owners of each active vessel remaining in the fishery will be required to pay an annually calculated percentage of their vessel's total revenue. The Buyback Authority would calculate the annual percentage based on the previous year's average prices such that the amount collected would cover the total debt service of the loan.

9) Vessel owners will be asked to vote to accept the results of the buyback and to formally bind the remaining fleet to repay the loan.

10) Assuming the fleet votes to accept the results and encumber themselves with repayment of the loan, the Buyback Authority will secure the loan, provide payment to winning bidders and permanently remove capacity from the IATTC Register.

The NEI Team reiterates here that the data provided to the team do not include landings from the WCPO waters that were made by vessels that are also participating in the EPO. Therefore, the NEI Team is only able to generate partial estimates of revenues, costs and NOR for vessels operating in both areas. Because of this limitation, the NEI Team is calling this assessment a capacity buyback rather than a vessel buyback. For purposed of this analysis, the NEI Team is presuming that after the buyback, vessel owners will retain title to their vessel, and that they can use the vessel in any way that is legally available to them, including participation in WCPO fishery. In any case, however, the NEI Team presumes that capacity once removed from the EPO Register will never be reinstated.

From a theoretical perspective, if a buyback requires the vessel to be scrapped, vessel owners would submit bids that would approach the expected future net earnings of all fisheries in which they are currently engaged, i.e., not only in the EPO but also in the WCPO. If a vessel is currently operating in both the EPO and the WCPO, its expected future net earnings would be higher than the estimated PVFE developed by the NEI Team.[24] From this perspective, if an actual buyback requires the vessel to be scrapped, it is likely that bid-values would be higher than estimated in this analysis.

Alternatively, if the buyback is a capacity buyback with revocation of the vessel's ability to fish in the EPO in the future—as is modelled here—vessel owners with fishing opportunities in other areas such as the WCPO, could conceivably "game" the system by submit lows and collecting buyback payments even though they may have no real intention to participate in the EPO in the future.

Vessels included in the Buyback Assessment and a Discussion of Heterogeneity of Vessel Fishing Operations

The assessment of the Buyback Program assumes that the 243 vessels that were active in the fishery from 2015 to 2016 continue to be active into the future. In addition to the 243 vessels that were active in either 2015 or 2016, the buyback includes the remaining 28 vessels operative vessels from the November 27, 2017 version of the IATTC Register that were not active during those years—these vessels are referred to as authorized/latent vessels in text and latent vessels in results tables. We note here that the current IATTC Register lists 271 purse seine vessels with a total hold capacity of 283,805 m^3—a level of capacity that is 14,178 m^3 more than was active in 2015 or 2016. The NEI Team is defining these vessels as "authorized/latent vessels" because they are registered and could enter the EPO fishery in the future. We have assigned PVFE values of zero to these vessels. Not explicitly included in the assessment of the buyback are the nine inactive or four sunk vessels that are currently listed in the Register. As discussed in Section

[24] This assumes, of course, that the PVFEs estimated by the NEI Team for the EPO are accurate.

4.1.3, these vessels have a total capacity of 5,697 m^3. The NEI Team will discuss the increment costs of removing these vessels in the discussion of the results.

Authorized/latent vessels, as well as vessels that have relatively low levels of participation, can have very negative consequences for a buyback or other capacity reduction programs, if these vessels are not among the vessels that are removed from the fishery. This is because it is relatively easy for latent or relatively less active vessels to significantly increase their levels of participation after the implementation of the program. If vessels disproportionately increase levels of activity, they can dilute the benefits of the buyback for vessels that have had historically higher levels of participation.[25]

It is also important to recognize that a buyback or similar capacity reduction options that cover the entire fleet will remove somewhat of a varied mix of capacity and fishing operations. As demonstrated in Sections 2.1 Dolphin vessels and FAD vessels have very different characteristics and focus on different mixes of species.

Dolphin vessels have much higher catch rates of YFT and much lower catch rates of BET, and Dolphin vessels comprise a larger percentage of vessels generating low or negative NOR. Thus, a general buyback using a straight reverse auction will tend to select Dolphin vessels before selecting FAD vessels for removal from the fishery. Since Dolphin vessels will tend to catch more YFT than BET, under these assumptions more YFT capacity will tend to be removed than BET capacity at each buyback level.

This has implications when estimating reductions in closure days that could result from a buyback. If greater amounts of YFT capacity are removed than BET capacity, then potential closure period reductions, when estimated using remaining YFT harvesting capacity, will be greater than potential closure period reductions estimated using remaining BET harvesting capacity. If the larger closure reductions as estimated by YFT capacity are implemented (i.e. with the result of shorter closure periods), then there is a greater chance that BET harvests will exceed targets set by the IATTC.

4.2.1.1 Buyback Scenarios included in the Assessment

Assessment of the vessel buyback includes six different bid/bid ranking scenarios that differ in the assumptions used by the NEI Team to assign bid amount for vessels that are projected to have negative or very low estimates for PVFE as developed and discussed in the simulation model described in Section 2.2.4.1. In all scenarios, if the minimum bid assumed by the NEI Team is greater than the estimated PVFE for a vessel, then it is assumed that the minimum is submitted by the vessel's owner rather than the vessel's estimated PVFE. The six scenarios are shown in the bulleted list that follows, noting that each scenario is described in much more detail on pages 80–83.

- Scenario 1 assumes a minimum bid of $1 million for all active vessels which had PVFE < $1 million. Authorized/Latent vessels are assumed to submit bids of $500,000. Bids are then divided by the vessel's capacity (m^3) and sorted from low to high. The buyback removes vessels until available funding is depleted, starting with the lowest adjusted bid and moving to successively higher bids.
- Scenario 2 assumes a minimum bid of $2 million for all active vessels which had PVFE < $2 million. Authorized/Latent vessels are assumed to submit bids of $1 million. Bids are then adjusted, sorted and selected in the same manner described for Scenario 1.

[25] It is possible to conceive of a buyback program that removes the most efficient operators from the fleet and leaves the fishery to authorized/latent vessels and vessels with relatively low productivity. In theory, such a buyback program could have a greater benefit for fish stocks and remove fewer vessels and less capacity than a program that targets less efficient vessels. Unfortunately, if the remaining fleet are the least efficient and least profitable vessels, they would not be able to afford to buy out the more efficient and more profitable vessels.

- Scenario 3 assumes a minimum bid of $3 million for all active vessels which had PVFE < $3 million. Authorized/Latent vessels are assumed to submit bids of $1.5 million. Bids are then adjusted, sorted and selected in the same manner described for Scenario 1.
- Scenario 4 assumes minimum bid amounts increase with capacity at an average of ≈ $2,207/m^3. Authorized/Latent vessels are assumed to submit bids of that are ≈ 1,104/m^3. Bids are then adjusted, sorted and selected in the same manner described for Scenario 1.
- Scenario 5 assumes minimum bid amounts increase with capacity at an average of $2,207/m^3. Authorized/Latent vessels are assumed to submit bids of that are ≈ 1,104/m^3. Bids are divided by capacity as in all other scenarios, but then the result is further weighted by multiplying the Bid$/m^3 by each vessel's average days at sea (DAS), calculated as a percentage of potential fishing days.[26] In this scenario, vessels with fewer DAS are more likely to be selected for removal than vessels with more DAS.
- Scenario 6 assumes the same minimum bid amounts as in the previous two scenarios. Bids are divided by capacity as in all other scenarios, but then the result is <u>inversely weighted</u> by dividing each vessel's average days at sea (DAS) calculated as a percentage of potential fishing days into the vessel's Bid$/m^3. In this scenario, vessels with more DAS are more likely to be selected for removal than vessels with fewer DAS.

The Buyback Assessment assumes as a starting point the current amount of operative capacity in the IATTC Register (i.e. 283,805 m^3). Within each buyback scenario, the NEI Team has included eight alternative capacity reduction scenarios as follows:

1) Reduce capacity to be ≤ 263,805 m3
2) Reduce capacity to be ≤ 243,805 m3
3) Reduce capacity to be ≤ 223,805 m3
4) Reduce capacity to be ≤ 203,805 m3
5) Reduce capacity to be ≤ 183,805 m3
6) Reduce capacity to be ≤ 171,000 m3 (i.e. the "Optimal Fleet" as estimated by Squires)
7) Reduce capacity to be ≤ 158,000 m3 (i.e. the "Optimal Fleet" as estimated by IATTC)
8) Reduce capacity by the minimum amount that will all eliminate closure days

The first five reduction options incrementally reduce the current capacity (283,805 m^3) by a minimum of 20,000 m^3—the actual reduction may be slightly higher, depending on the capacity of the last vessel removed.[27] Thus Option 4 reduces the current capacity by at least 80,000 m^3 to 203,805 m^3.

The last three options in each scenario reduce that fleet down to "optimal" fleets. Option 6 reduces the fleet to 171,000 m^3; this is the optimal as estimated by Squires (Squires, 2014). Option 7 reduces the fleet to 158,000 m^3—the optimal level of stated in the IATTC Capacity Resolution C-03-02 (IATTC,2002). Finally, Option 8 defines the optimal fleet, as the fleet which—assuming zero closure days—can harvest the maximum portions of the status quo harvests of BET and YFT without exceeding status quo harvests.

[26] Potential fishing days equal the number of calendar days in a year after subtracting the 62-day closure period. Since 2016 was a leap year, the average potential fishing days from 2014 to 2016 equals 303.33.

[27] The variation in actual reduction across scenarios occurs because vessel bids are sorted differently in each buyback scenario.

The discussion that follows describes in more detail the differences between the six scenarios and provides rationales for their inclusion. The discussion around each scenario also includes caveats the NEI Team believes are important.

Scenario 1: Buyback with a Minimum Bid of $1 Million Ranked by Lowest Bid per m³ of Capacity

This buyback assumes a minimum bid amount of $1 million from active vessels and minimum bids of $500,000 for the 28 authorized/latent vessels.[28] There are 27 vessels with PVFE of less than $1 million, including:

- 24 vessels with negative future earning streams (i.e. PVFE >0)
- 3 vessels with positive PVFE, but which are less than $1 million

The NEI Team believes Scenario 1 represents a lower-end estimate of potential bid amounts for vessels that are relatively unprofitable. The scenario assumes that once all bids are collected by the "Buyback Authority", they then divide all bids by the vessel's capacity (m^3). The Bid$/$m^3$ amounts are then ranked from low to high and as many vessels as can be purchased within the available funding, or to attain the capacity reduction goal, will be bought out of the fishery. Dividing submitted bids by cubic meters of capacity will have the effect of removing larger vessels from the fishery before removing smaller vessels if the vessels have bids of similar values. Table 22 provides an example of bid values and buyback ranking under Scenario 1 of four hypothetical vessels.

Table 22. Bid Amounts and Buyback Rankings of Four Hypothetical Vessels under Scenario 1

Vessel ID	PVFE	Capacity (m^3)	DAS	DAS% of Potential	Bid Amount	Bid$/$m^3$	Buyback Rank
Scenario 1: ($1 million is bid if PVFE < $1 million)							
Vessel 1	($1,203,302)	1,400	50	16%	$1,000,000	$714.29	1
Vessel 2	$2,923,926	1,600	250	82%	$2,923,926	$1,827.45	2
Vessel 3	$5,982,862	2,600	100	33%	$5,982,862	$2,301.10	3
Vessel 4	$1,998,305	800	250	82%	$1,998,305	$2,497.88	4

In Table 22, the least profitable vessel will be the first vessel to be bought out of the fishery. Vessel 2, which has the second highest levels of profits, will be the second vessel taken out of the fishery because its bid amount relative to its capacity is second lowest. Vessel 4, with relatively low levels of profit, will be the last of the four vessels removed from the fishery because it generates the highest profit per m^3 of capacity.

This scenario will yield the lowest buyback costs of any of the scenarios shown, and costs under this scenario should be compared to Scenario 2 & 3, which assume a $2 million and $3 minimum bid respectively.

The NEI Team cautions that minimum bid amounts in Scenario 1 are not estimated using empirical evidence, and at best represent a well-reasoned guess of the lower end of potential minimum bids. If an actual buyback were to occur, it is assumed that bid amounts for unprofitable vessels or for latent vessels will be based at least in part on the amount of debt the vessel owner has accrued while owning and operating the vessel. Bids will also take into account the prices of the vessels that have recently been sold

[28] The NEI Team makes the assumption that latent vessels are either less profitable than other vessels that are active, or that the vessels are not fully seaworthy. In either case, it appears reasonable to assume that the minimum bid of a latent vessel should be smaller than the minimum bid of an operative vessel. Therefore, the NEI Team assumes under all scenarios that minimum bids of latent vessels will be half the minimum bid of similar sized operative vessels.

on the market. In any case, the NEI Team recommends using these results for comparative purposes only, and only as a preliminary assessment of the costs of a buyback program for the EPO Purse Seine Fishery. The NEI Team welcomes input from the industry regarding minimum bid amounts they believe are reasonable.

Scenario 2: Buyback with a Minimum Bid of $2 Million Ranked by Lowest Bid per m^3 of Capacity

This buyback scenario assumes a $2 million minimum bid amount and $1 million for the 28 authorized/latent vessels. As in the previous scenario, all bids are divided by the vessel's capacity (m^3) resulting in Bid$/$m^3$, which are then sorted from low to high for selection of vessels to be bought out. The NEI Team believes this represents a mid-range estimate of potential bid amounts for vessels that are relatively unprofitable. Estimates of PVFE indicate that 30 vessels are projected to have PVFE less than $2 million.

This scenario will yield buyback costs that are generally higher than costs for similar reductions in the first scenario, but lower than costs under other scenarios. Table 23 shows bid amount and ranking under Scenario 2. Note that values for each vessel's PVFE, Capacity, DAS, and DAS% of Potential are unchanged from Scenario 1. However, the bid amount for Vessels 1 and 4 have increased from $1 million to $2 million. The increased bid amounts in this example do not cause buyback ranks to change.

Table 23. Bid Amounts and Buyback Rankings of Four Hypothetical Vessels under Scenario 2

Vessel ID	PVFE	Capacity (m^3)	DAS	DAS% of Potential	Bid Amount	Bid$/ m^3	Buyback Rank
Scenario 2: ($2million is bid if PVFE < $2 million)							
Vessel 1	($1,203,302)	1,400	50	16%	$2,000,000	$1,428.57	1
Vessel 2	$2,923,926	1,600	250	82%	$2,923,926	$1,827.45	2
Vessel 3	$5,982,862	2,600	100	33%	$5,982,862	$2,301.10	3
Vessel 4	$1,998,305	800	250	82%	$2,000,000	$2,500.00	4

Scenario 3: Buyback with a Minimum Bid of $3 Million Ranked by Lowest Bid per m^3 of Capacity

This buyback scenario assumes a $3 million minimum bid amount and $1.5 million for the 28 authorized/latent vessels. The NEI Team believes this may be a high-end estimate of potential bid amounts for vessels that are relatively unprofitable. Estimates from the PVFE simulation indicate that 36 vessels are projected to have PVFE less than $3 million.

This scenario will yield buyback costs that are the highest of the three fixed minimum bid scenarios (i.e. Scenarios 1, 2, & 3). Table 24 shows bid amounts and ranking of the same four vessels. Note that three of the vessel are now assumed to submit bids of $3 million and that the order of vessels that are removed from the fishery has changed.

Table 24. Bid Amounts and Buyback Rankings of Four Hypothetical Vessels under Scenario 3

Vessel ID	PVFE	Capacity (m^3)	DAS	DAS% of Potential	Bid Amount	Bid$/ m^3	Buyback Rank
Scenario 3: ($3 million is bid if PVFE < $3 million)							
Vessel 2	$2,923,926	1,600	250	82%	$3,000,000	$1,875.00	1
Vessel 1	($1,203,302)	1,400	50	16%	$3,000,000	$2,142.86	2
Vessel 3	$5,982,862	2,600	100	33%	$5,982,862	$2,301.10	3

Vessel 4	$1,998,305	800	250	82%	$3,000,000	$3,750.00	4

Scenario 4: Buyback with Minimum Bids Scaled by Vessel Size, Ranked by Lowest Bid per m^3 of Capacity

This buyback scenario assumes that minimum bid amounts are calculated by grouping vessels into eight size bins and then assigning fixed minimum bids amounts for each category. For vessels that equal the maximum size for the bin, their bid would equal $2000/$m^3$. For smaller vessels within the bin, bid amounts per m^3 will be slightly higher. On average, minimum bid amounts are ≈ $2,207 × m^3 of capacity. Authorized/Latent vessels are assumed to submit bids that are 50 percent less than bids of similarly sized active vessels. Once all the bid amounts are collected, the "Buyback Authority" will then divide by the vessel's capacity (m^3) and sort from low to high. Under Scenario 4, a total of 36 vessels are assumed to submit minimum bids that exceed their estimated PVFE—33 of these 36 are the same vessels that are assumed to have submitted minimum bids under Scenario 3.

The NEI Team believes the scaled minimum bid amounts in this scenario may be more realistic than the fixed minimum bid amounts used in Scenario 1–3, although the actual dollar amount per m^3 is still very uncertain. Table 25 shows the bid amounts and the buyback ranking of the four hypothetical vessels. Note that all four vessels submit bids that are greater than their estimated PVFE. Also note that the rankings have changed from the previous scenario.

Table 25. Bid Amounts and Buyback Rankings of Four Hypothetical Vessels under Scenario 4

Vessel ID	PVFE	Capacity (m^3)	DAS	DAS% of Potential	Bid Amount	Bid$/$m^3$	Buyback Rank
			Scenario 4: (minimum bids vary by capacity)				
Vessel 2	$2,923,926	1,600	250	82%	$3,333,000	$2,083.13	1
Vessel 3	$5,982,862	2,600	100	33%	$6,000,000	$2,307.69	2
Vessel 1	($1,203,302)	1,400	50	16%	$3,333,000	$2,380.71	3
Vessel 4	$1,998,305	800	250	82%	$2,000,000	$2,500.00	4

Scenario 5: Buyback with Minimum Bids Scaled by Vessel Size, Weighted by Days at Sea Percentages

This buyback assumes a minimum bid amount calculated as ≈ $2,207 × m^3 of capacity as in Scenario 4. As in all Scenarios, all bids are divided by the vessel's capacity (m^3), resulting in Bid$/$m^3$. In this scenario however, the NEI Team also weights Bid$/$m^3$ values by multiplying each vessel's Bid$/$m^3$ amount by that vessel's average DAS as a percent of potential DAS after subtracting the 62-day closure periods (i.e. 365 – 62 days). The weighted bids are then sorted from low to high.

The weighting scheme in this scenario has the effect of buying out vessels that have relatively low activity levels, and that are also relatively unprofitable. Authorized/Latent vessels will be the first vessels selected because by definition, they have had zero participation days. Vessels which have relatively high levels of activity are more likely to be a part of the remaining fleet, unless they are also very unprofitable. By ensuring that all the latent and many of the less active vessels are removed from the fishery, this scenario has relatively low risk that individual vessels in the remaining fleet will expand effort disproportionately. Table 26 shows bid amounts and the buyback rankings for the same four hypothetical vessels. Note that vessels with the lowest DAS percentage of potential DAS are removed in this buyback before vessels with higher levels of participation.

Table 26. Bid Amounts and Buyback Rankings of Four Hypothetical Vessels under Scenario 5

Vessel ID	PVFE	Capacity (m^3)	DAS	DAS% of Potential	Bid Amount	Bid$/ m^3	Buyback Rank
		Scenario 5: (minimum bids vary by capacity; weight by DAS%)					
Vessel 1	($1,203,302)	1,400	50	16%	$1,000,000	$117.74	1
Vessel 3	$5,982,862	2,600	100	33%	$5,982,862	$758.61	2
Vessel 2	$2,923,926	1,600	250	82%	$2,923,926	$1,506.16	3
Vessel 4	$1,998,305	800	250	82%	$1,998,305	$2,058.72	4

Scenario 6: Buyback with Minimum Scaled by Vessel Size, Weighted Inversely by Days at Sea Percentages

This buyback scenario assumes the same minimum bid amounts calculated as in Scenario 4 and 5. As in all scenarios, all bids are divided by the vessel's capacity (m^3) resulting in Bid$/$m^3$. In this scenario however, we inversely weight each Bid$/$m^3$ amount value by dividing each vessel's Bid$/$m^3$ amount by that vessel's average DAS participation rate. The DAS participation rate is the total number of days at sea in a year as a percent of available days after deducting the closure period (i.e. 365 – 62 days). The resulting inversely weighted bids are then sorted from low to high. This weighting scheme has the effect of buying out vessels that are heavily engaged in fishing (i.e. they have relative high DAS), but which are also relatively unprofitable. Vessels which have very low levels of engagement in the fishery (including latent vessels) will be the lowest ranked vessels and are very unlikely to be bought out of the fishery.

As shown in the results, this buyback is very effective in reducing effective fishing capacity by buying out relatively few vessels per closure day. If we assume that the remaining fleet does not increase their harvest per available fishing calendar day relative to their historical pattern, closure periods can be reduced to zero by buying out only 43 vessels. This is the lowest number of bought-out vessels of any of the buyback scenarios shown at the point of reaching zero closure days.

This buyback scenario is also likely to be fairly disruptive—it buys out boats that have relatively high levels of fishing activity in terms of DAS, and leaves vessels in the fishery that have not had high levels of participation in terms of DAS. We would also expect that because the remaining fleet has lower levels of fishing activity in general, that many of the vessels would likely change their fishing patterns, becoming more active. This would mean that the estimated gains of the buyback in terms of closure day reductions are probably more likely to dissipate over time. Table 27 shows the bid amounts and buyback rankings under Scenario 6 of the same four hypothetical vessels.

Table 27. Bid Amounts and Buyback Rankings of Four Example Vessels under Scenario 6

Vessel ID	PVFE	Capacity (m^3)	DAS	DAS% of Potential	Bid Amount	Bid$/ m^3	Buyback Rank
		Scenario 6: (minimum bids vary by capacity; inverse weighting by DAS%)					
Vessel 2	$2,923,926	1,600	250	82%	$2,923,926	$2,217.29	1
Vessel 4	$1,998,305	800	250	82%	$1,998,305	$3,030.73	2
Vessel 1	($1,203,302)	1,400	50	16%	$1,000,000	$4,333.29	3
Vessel 3	$5,982,862	2,600	100	33%	$5,982,862	$6,979.93	4

4.2.1.2 Summary of Buyback Results

Summary results of the Buyback Program are provided below. The summary results assume that the buyback program is funded entirely through a commercial loan with a 20-year repayment schedule and a 12 percent rate of interest. In reality, there are thousands of potential variations in funding options that could be used. These include longer or shorter repayment schedules and higher or lower interest rates. In addition, it is possible CPCs or non-governmental organizations will provide some grant funding, particularly if the buyback appears to have real potential to permanently reduce capacity in the EPO purse seine fishery.

To capture the huge range of potential funding options for the buyback program, the NEI Team has also developed an Interactive Buyback Spreadsheet Model (IBSM). The IBSM includes results from six different bid/bid ranking Buyback Scenarios described above—each with eight alternative capacity reduction targets removing as little as 20,000 m^3 to as much as 126,000 m^3 of capacity.

In addition to the basic results for Buyback Scenarios and Capacity, the IBSM allows users to specify a wide range of different financing options for the buyback. Users of the IBSM can specify the terms of the buyback loan by selecting the number of years for repayment (5 to 40 years) and the interest rate (2 to 22 percent). Users can also specify a grant amount that could offset some or all, of the buyback loan.

Appendix B at the end of this report contains detailed tables for each of the 48 distinct buyback options (6 scenarios × 8 capacity reduction levels = 48 distinct options). The tables in the appendix all assume that 100 percent of the buyback is financed with a 20-year loan at an annual interest rate of 10 percent.

The summary results that are provided here show projected outcomes under all six scenarios for three buybacks which differ in the amount of capacity removed. Included are:

1) a buyback that removes 40,000 m^3 of capacity;
2) a buyback that removes 80,000 m^3 of capacity;
3) a buyback that removes capacity to levels at which closure days can be eliminated.

The default assumption for financing used in the summary of results below is that grant funding for a buyback is not available and that the buyback loan would have a 20-year payback schedule with an annual interest rate of 10 percent. This default financing assumption represents a relatively expensive loan (relative to other buyback loans about which the NEI Team has knowledge), and thus the summary results depict a relatively expensive buyback program.

For each of the three buyback levels summarized below, a series of four tables are provided:

- Table 28, Table 32, and Table 36 provide a general fleetwide summary of the buyback;
- Table 29, Table 33, and Table 37 provide general results for FAD Vessels;
- Table 30, Table 34, and Table 38 provide general results for Dolphin Vessels;
- Table 31, Table 35, and Table 39 provide additional details for the buyback.

<u>Summary Results for a Buyback that Removes 40,000 m^3 of Capacity</u>

In this buyback, a target of 40,000 m^3 capacity is removed under each of the six scenarios. As shown in Table 28 on page 86, a buyback that removes 40,000 m^3 of capacity is projected to remove between 24 and 47 vessels depending the scenario. Total cost of the buyback is projected to range from a low of $27 million under Scenario 1 to a high of $98 million under Scenario 5. Post-buyback closure days are expected to range from 60 closure days under Scenario 5 to 30 days under Scenario 6.[29]

Table 28 presents a general summary of a buyback for the fleet as a whole under each of the six bidding/ranking scenarios. The table is divided into three sections with the first section showing vessels and capacity that are removed from the fishery as well as the estimated number of closure days that the NEI Team estimates would result. The second section summarizes the NEI Team's estimates of revenue and NOR gains that could be attained by the fleet after the buyback. The third section summarizes the expected costs of the buyback and payments that would be required to repay the buyback loan assuming the default terms without grants. Table rows are numbered to facilitate referencing.

As seen in the top section of the table, all six scenarios remove approximately the same amount of capacity (≈ 40,000 m^3), but there are large differences in the effectiveness of the program across scenarios. Under Scenario 2 (with a $2 million minimum bid), the buyback would remove 24 vessels (row 1) and none of the vessels removed would be latent (row 2). Under Scenario 1 (which assumes a $1 million minimum bid, 31 vessels would be removed, 8 of which are latent. Under Scenario 2, the NEI Team estimates the closure period could be reduced to 36 days (row 6) assuming that the remaining active fleet expands their effort and harvest in proportion to their current effort and harvest. The standard assumption is that latent vessels that remain after the buyback continue to be latent, and that vessels that have in the past been relatively inactive, do not increase their effort disproportionately.

Scenarios 3 and 6 have the same issue as Scenario 2—none of the latent vessels are removed. The NEI Team notes that if owners of latent vessels are required to make buyback payments, then it is virtually certain the owners of this latent capacity will find a way to generate revenues through its use in the fishery or by transferring capacity to another vessel. The implication of this is that latent vessels that remain a part of the fleet after the buyback are likely to erode the projected benefits of the buyback.

The second section of Table 28 summarizes additional revenue generation resulting from the projected reductions in closures days. The NEI Team notes that revenue and NOR gains shown in this section of the table are exclusive of the cost of the buyback or the loan payments that will be required of the remaining fleet. As shown in row 7, fleetwide revenues are expected to decline relative to the status quo (SQ) with the exception of Scenario 2. While fleetwide harvests of SKJ are expected to increase, fleetwide harvests of BET and YFT are constrained by the closure periods and by the catching power of the remaining vessels. While fleetwide harvests of BET and YFT do not increase, harvest of these species by individual remaining vessels is expected to increase because they now have additional fishing days available to them. Depending on the scenario, revenue gains per vessel are expected to range from 0.5 to 10.3 percent (Row 8). The final row in this section (row 9) shows the average increase in NOR for the average vessel remaining in the fleet. NOR increases range from $69,811 to $130,227 under Scenarios 1–4, but are much smaller under Scenario 5 ($9,116/vessel) and higher under Scenario 6 ($164,446/vessel). Recall that Scenario 5 is set up to prioritize removal of less active vessels, while Scenario 6 is set up to prioritize removal of vessels with greater levels of activity.

The third section of Table 28 summarizes the estimated loan repayment costs of the remaining fleet. Row 10 shows the expected total cost of the buyback, which is also equal to principal of the buyback loan, since it is assumed in the default scenario that no grant funding is available. Comparing the total buyback cost across scenarios clearly demonstrates the impact of assumed minimum bid amounts—the lower the minimum bid, the lower the cost of the buyback. Row 11 shows the total cost of the buyback per m^3 of capacity removed under the buyback. Row 12 shows the total annual loan payment that would be required of the remaining fleet, while row 13 divides that total loan payment by the number of remaining active vessels (row 3) to estimate the average loan payment per vessel. In row 14, the average loan payment (row

[29] The NEI Team notes that actual reductions in closure days under a buyback would be calculated by the ITTAC staff based on stock assessment information on harvest during the most recent years of activity.

13) is subtracted from the NOR Gains (row 9) resulting in an estimate of average NOR/vessel net of the average buyback fee. If this number is positive, then on average, vessels are better off with the buyback. Row 15 is the ratio of the Net NOR (row 14) to the average fee (row 13) and provides an additional measure of the potential benefits of the buyback relative to its costs. Row 16 shows the repayment fee as a percent of estimated total revenue for the remaining fleet. If repayment of the buyback loan is set as a fixed percentage fee on gross revenues, then incentives for latent vessels to activate are reduced. Finally, row 17 shows the projected loan repayment fee per m^3 of the remaining fleet—if this type of fee is used, then remaining vessels will know their loan repayment fee with certainty, but there will be greater incentive for latent and less active vessels to disproportionately increase their effort to cover their buyback fees.

Table 28. General Fleetwide Buyback Results by Scenario for the Removal of 40,000 m^3 of Capacity

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	$1M Minimum Bid	$2M Minimum Bid	$3M Minimum Bid	Minimum Bid Varies by m^3	Variable Min. & Weight by DAS	Variable Min. & Inverse Weighting
	Remove 40,000 m^3 of Capacity—Remaining Capacity is ≤ 243,805 m^3					
1) Number of Vessels Removed	31	24	24	47	45	28
2) Number of Latent Vessels Removed	8	0	0	28	28	0
3) Number of Active Vessels Remaining	220	219	219	224	226	215
4) Capacity Removed (m^3)	40,154	40,283	41,295	40,064	40,408	40,111
5) Capacity Remaining (m^3)	243,651	243,522	242,510	243,741	243,397	243,694
6) Estimated Post-Buyback Closure Days	39	36	41	49	60	30
	Increased Revenues After the Buyback Due to Reductions in Closure Days					
7) Estimated Fleetwide Revenue as a Percent of Fleetwide SQ Revenue	99.7%	100.7%	99.2%	98.2%	98.9%	96.1%
8) Estimated Revenue per Remaining Active Vessel as a Percent of SQ	107.4%	108.3%	106.7%	104.1%	100.5%	110.3%
9) Estimated NOR Gain per Active Vessel Exclusive of Buyback Fees	$120,768	$130,227	$104,354	$69,811	$9,116	$164,446
	Repayment of Buyback Loan with Zero Grant Funding: Loan has a 20-year term and 10% interest					
10) Total Vessel Buyback Cost—the Loan Principal Without Interest ($Millions)	$27.19	$49.69	$72.77	$72.65	$98.42	$92.41
11) Cost ($) per m^3 of Capacity Removed	$677	$1,234	$1,762	$1,813	$2,436	$2,304
12) Total Annual Loan Payment ($Millions)	$3.19	$5.84	$8.55	$8.53	$11.56	$10.85
13) Average Loan Payment ($) per Remaining Active Vessel	$14,515	$26,651	$39,028	$14,515	$51,153	$50,485
14) Net NOR Gains ($) per Active Vessel after Deducting the Buyback Fee	$117,232	$120,225	$78,668	$117,232	($42,037)	$135,377
15) Ratio of Net NOR Gains to Annual Fee	8.08	4.51	2.02	0.83	-0.82	2.68
16) Loan Repayment Fee as a Percent of Future Annual Revenue	0.4%	0.6%	0.9%	1.0%	1.3%	1.2%
17) Loan Repayment Fee / Remaining m^3	$13.11	$23.97	$35.24	$35.01	$47.50	$44.54

The buyback results summarized in Table 28 above indicate that for the fleet as a whole, a vessel buyback that removes 40,000 m^3 of capacity would generate net gains in NOR even after accounting for buyback loan repayment fees. An exception is seen Scenario 5, which is set up to prioritize removal of less active vessels. The next two tables drill down to separately examine the impacts of the 40,000 m^3 vessel buyback on the two main classes of vessels—FAD vessels (Table 29) and Dolphin vessels (Table 30). The structures of the two tables are identical to each other, and similar in form to Table 28.

The first section of both tables describes the results of the buyback in terms of vessels and capacity removed from the fleet, and vessels and capacity that remain. The second section of both tables provides estimates of changes in gross revenue relative to the status quo (SQ) and along with gains in NOR. Sections three and four of both tables provide estimates of buyback fees and NOR per vessel after deducting the fees. These last two sections differ in terms of the way that buyback fees are calculated. The third section calculates Net NOR by deducting the fleetwide average fee from average NOR of each vessel type, while the fourth section calculates Net NOR by deducting the fleetwide buyback cost per m^3 from average NOR of each vessel type.

A comparison of the estimated results of a 40,000 m^3 buyback for FAD vessels (Table 29) to results for Dolphin vessels (Table 30) reveals that FAD vessels may be more likely to realize greater benefits from a fleetwide buyback than Dolphin vessels under Scenarios 1, 2, and 5, but that Dolphin vessels may realize greater benefits than FAD vessels under Scenarios 3, 4 and 6. The summary that follows will compare results for FAD vessels and Dolphin vessels on a row-by-row basis.

- As seen in Row 1, more Dolphin vessels than FAD vessels are removed under Scenarios 1, 2, 3 and 6, and more FAD vessels are removed under Scenarios 4 and 5.
- As seen in Row 5, the average capacity per remaining Dolphin vessel exceeds the average capacity per remaining FAD vessel by an average of 381 m^3. Based on data shown in Figure 8 on page 18, the average dolphin vessel is larger than the average FAD vessel.
- Row 6 reveals that combined total revenue for remaining FAD vessels under the buyback exceed total revenues under the status quo. For Dolphin vessels, the opposite occurs—total revenues under the buyback are less than under the status quo. These results occur because FAD vessels can expand their harvest of SKJ beyond status quo harvest levels, while Dolphin vessels which primarily target YFT are constrained by the remaining closure days to remain at or below status harvest.
- Row 7 shows that the average revenue per vessel under the buyback for both FAD vessels and Dolphin vessels exceeds average revenue per vessel under the status quo. In addition, the magnitude of gains is similar for FAD vessels and Dolphin vessels under most of the scenarios.
- Row 8 reveals mixed results for NOR Gains per Vessel. Under Scenarios 3, 4, and 6, the average Dolphin vessel is projected to have larger gains in NOR than FAD vessels, while the opposite is true for Scenarios 1, 2, and 5.
- Row 9 for both tables shows the fleetwide average fee per vessel over both vessel types and is copied directly from Row 13 of Table 28.
- In Row 10, the average buyback fee per vessel is deducted from NOR gains per vessel in Row 9. The result is the Net NOR gain per vessel after deducting the average cost vessel of the buyback. The results are similar to results from Row 8.
- Row 11 shows the ratio of annual NOR gains per vessel (from Row 10) to the fleetwide average buyback fee from Row 9. Under Scenario 2, the ratio for the average FAD vessels is 5.56 while the ratio for the average Dolphin vessel is 2.76. Ratios greater than two imply that net NOR gains are more than twice the size of the loan repayment fee.
- Row 12 shows the estimated buyback fee per vessel if the fee is calculated based on the capacity (m^3) of remaining vessels. This fee is calculated by multiplying the "Loan Repayment Fee / Remaining m^3" from Row 17 of Table 28 by average capacity of the FAD and Dolphin vessels from Row of Table 29 and Table 30 respectively. Since the average FAD vessels is relatively small compared to the average Dolphin vessel, the average loan repayment fee for FAD vessels calculated on fixed rate per m^3 is also relatively small.

- In Row 13, the average capacity-based buyback fee per vessel is deducted from the NOR gains per vessel in Row 9. The result is the average Net NOR gain per vessel after deducting the capacity-based loan repayment fee.
- Finally, Row 14 shows the ratio of the Net NOR gain per vessel from Row 13 to the capacity-based loan repayment fee from Row 12. Ratios greater than two imply that net NOR gains are more than twice the size of the capacity-based loan repayment fee.

Table 29. General Results for FAD Vessels of a 40,000 m^3 Buyback

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	$1M Minimum Bid	$2M Minimum Bid	$3M Minimum Bid	Variable Minimum Bid	Variable Min. & Weight by DAS	Variable Min. & Inverse Weighting
Remove 40,000 m^3 of Capacity—Remaining Capacity is ≤ 243,805 m^3						
1) Number of FAD Vessels Removed	8	11	11	11	15	6
2) Number of FAD Vessels Remaining	149	146	146	146	142	151
3) FAD Vessel Capacity Removed (m^3)	14,179	19,461	20,310	13,615	23,586	8,641
4) FAD Vessel Capacity Remaining (m^3)	139,806	134,524	133,675	140,370	130,399	145,344
5) Average Capacity (m^3) / Remaining FAD Vessel	938	921	916	961	918	963
Revenues and NOR After the Buyback but Before Accounting for the Cost of the Buyback						
6) Estimated Total FAD Vessel Revenue as a Percent of SQ Revenue	104.8%	104.8%	103.6%	99.9%	98.4%	105.7%
7) Estimated Revenue / FAD Vessel as a Percent of SQ	107.7%	108.7%	107.0%	104.2%	100.6%	110.8%
8) NOR Gains / Active FAD Vessel	$154,835	$177,395	$143,299	$86,155	$11,665	$214,060
Fleetwide Average Buyback Fees and FAD Vessel NOR After Deducting Fleetwide Average Buyback Fees						
9) Fleetwide Average Payment / Active Vessel (Includes both FAD & Dolphin vessels)	$14,515	$26,651	$39,028	$38,093	$51,153	$50,485
10) NOR Gains / FAD Vessel Net of the Average Buyback Fee	$140,320	$150,744	$104,272	$48,061	($39,488)	$163,575
11) Ratio of Annual Net NOR Gains to Annual Fee	9.67	5.66	2.67	1.26	-0.77	3.24
Fleetwide Buyback Fees per m^3 and FAD Vessel NOR after Deducting Estimated Buyback Fees						
12) Repayment Fee (using Fleetwide Fee $/ m^3) for the Average FAD Vessel	$12,297	$22,084	$32,269	$33,658	$43,616	$42,872
13) NOR Gains / FAD Vessel Net of the Average Fee per m^3	$142,538	$155,312	$111,031	$52,497	($31,952)	$171,188
14) Ratio of Annual Net NOR Gains to Annual Fee per m^3	11.59	7.03	3.44	1.56	-0.73	3.99

Table 30. General Results for Dolphin Vessels of a 40,000 m^3 Buyback

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	$1M Minimum Bid	$2M Minimum Bid	$3M Minimum Bid	Variable Minimum Bid	Variable Min. & Weight by DAS	Variable Min. & Inverse Weighting
Remove 40,000 m^3 of Capacity—Remaining Capacity is ≤ 243,805 m^3						
1) Number of Dolphin Vessels Removed	15	13	13	8	2	22
2) Number of Dolphin Vessels Remaining	71	73	73	78	84	64
3) Dolphin Vessel Capacity Removed (m^3)	21,923	20,822	20,985	12,271	2,644	31,470
4) Dolphin Vessel Capacity Remaining (m^3)	93,719	94,820	94,657	103,371	112,998	84,172
5) Average Capacity (m^3) / Remaining Dolphin Vessel	1,320	1,299	1,297	1,325	1,345	1,315
Revenues and NOR After the Buyback but Before Accounting for the Cost of the Buyback						
6) Estimated Total Dolphin Vessel Revenue as a Percent of SQ Revenue	93.1%	95.6%	93.6%	95.9%	99.7%	83.6%
7) Estimated Revenue / Dolphin Vessel as a Percent of SQ	107.6%	108.6%	106.9%	104.2%	100.6%	110.7%
8) NOR Gains / Dolphin Vessel	$93,912	$100,155	$79,750	$44,754	$5,640	$143,697
Fleetwide Average Buyback Fees and Dolphin Vessel NOR After Deducting Fleetwide Average Buyback Fees						
9) Fleetwide Average Payment / Active Vessel Table 31(Includes both Dolphin & Dolphin vessels)	$14,515	$26,651	$39,028	$38,093	$51,153	$50,485
10) NOR Gains / Active Dolphin Vessel Net of the Average Buyback Fee	$79,398	$73,504	$40,722	$6,661	($45,513)	$93,212
11) Ratio of Annual Net NOR Gains to Annual Fee	5.47	2.76	1.04	0.17	-0.89	1.85
Fleetwide Buyback Fees per m^3 and Dolphin Vessel NOR after Deducting Estimated Buyback Fees						
12) Repayment Fee (using Fleetwide Fee $/ m^3) for the Average Dolphin Vessel	$17,300	$31,132	$45,700	$46,395	$63,893	$58,579
13) NOR Gains / Dolphin Vessel Net of the Average Fee per m^3	$76,613	$50,485	$50,485	($1,641)	($58,254)	$85,118
14) Ratio of Annual Net NOR Gains to Annual Fee per m^3	4.43	1.62	1.10	-0.04	-0.91	1.45

Table 31 provides additional details about a buyback that removes 40,000 m^3 of capacity, under the six scenarios. The additional details in this table provide breakouts of additional expected revenue per remaining active vessel by species and allows readers to gain a better understanding of the sources of additional revenue that are expected to be generated.

The second section of Table 31 provides additional information about the boats that were bought out and the boats that are remaining. Row 8, for example, indicates that from 6 to 17 unprofitable vessels remain in the fleet when 40,000 m^3 of capacity is removed. Row 10 shows the number of vessels that are assumed to sell at the minimum bid amounts for each scenario.

The third section of Table 31 shows the number of FAD and Dolphin vessels that are expected in the remaining active fleet; these were described in more detail in the previous two tables. Under the status quo, there were approximately 55 Dolphin vessels for every 100 FAD vessels. With a 40,000 m^3 buyback, under Scenarios 1–3 there are approximately 49 Dolphin vessels for every 100 FAD vessels; under Scenario 4, the ratio increases to 53:100; while in Scenario 5, the ratio increases to 59:100. Finally, under Scenario 6, the ratio drops to 42:100. In scenarios where proportionally more Dolphin vessels are removed than FAD vessels (all scenarios with the exception of Scenario 5), the remaining fleet will be able to catch the "sustainable harvest level" of BET sooner than the "sustainable harvest level" of YFT. This is because Dolphin vessels target YFT and catch very little BET—removing proportionally more Dolphin vessels than FAD vessels could result in different catching power between YFT and BET. This is one of the key findings of the vessel buyback assessment—specifically that there are differential effects depending on the catch histories of the vessels removed. Thus, the design of the buyback should try to remove proportional levels of catching power for the two key species to meet the IATTC's conservation targets. This finding is discussed in greater detail in Section 4.2.1.3.

The final section of Table 31 summarizes changes in vessels by country type. Under scenarios 1–4, the relative proportions for each country type remain similar to those from the status quo. Under Scenario 5, FAD countries have proportionally fewer vessels in the remaining fleet, and under Scenario 6 FAD countries have proportionally more vessels in the remaining fleet.

Table 31. Additional Details by Scenario for a Buyback Removing 40,000 m^3 of Capacity

Item	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
1) Additional Revenue / Remaining Active Vessels from BET	$28,310	$31,855	$26,123	$15,833	$2,141	$39,631
2) Additional Revenue / Remaining Active Vessels from YFT	$120,240	$137,723	$109,983	$67,509	$9,401	$152,858
3) Additional Revenue / Remaining Active Vessels from SKJ	$133,648	$150,331	$121,684	$72,351	$9,654	$187,661
4) Total Additional Revenue / Remaining Active Vessels	$282,198	$319,909	$257,790	$155,693	$21,196	$380,150
5) NOR / Remaining Active Vessel as a % of SQ	118%	117%	126%	107%	101%	134%
6) Total Number of Active vessels remaining (from 246)	220	219	219	224	226	215
7) Total Number of Latent vessels remaining (from 28)	20	28	28	0	0	28
8) Unprofitable Vessels in the Remaining Active Fleet (from 24)	7	10	13	16	19	15
9) Profitable Vessels in the Remaining Active Fleet (from 217)	213	209	206	208	207	200
10) Vessels Assumed to Sell Out at the Minimum Bid	30	20	22	47	40	23
11) FAD Vessels in the Remaining Active Fleet (from 157)	149	146	146	146	142	151
12) Dolphin Vessels in the Remaining Active Fleet (from 86)	71	73	73	78	84	64
13) Remaining Active Vessels: FAD Vessel Countries (from 143)	134	131	131	133	128	138
14) Remaining Active Vessels: Dolphin Vessel Countries (from 66)	57	58	58	60	64	49
15) Remaining Active Vessels: Mixed Vessel Countries (from 34)	29	30	30	31	34	28

Summary Results for a Buyback that Removes 80,000 m^3 of Capacity

A Buyback that removes 80,000 m^3 of capacity from the EPO purse seine tuna fleet is summarized in Table 32 through Table 35 on the pages that follow. These tables are organized in the same way as the four tables in the previous section:

- Table 32 provide a general fleetwide summary by scenario
- Table 33 and Table 34 provide summaries of FAD vessels and Dolphin vessels similar to what is shown for the fleet as a whole in Table 32.
- Table 35 provides additional details on revenue sources and remaining vessels by type.

The review of results from the 80,000 m^3 buyback as summarized in Table 32 will highlight the important differences between this option and the previous option removing 40,000 ^{m3}:

- Over all the scenarios, there are an average of 67 vessels removed with an 80,000 m^3 buyback, more than double the removals with a 40,000 m^3 buyback.
- All latent vessels are removed under Scenarios 1, 2, 4, and 5, but no latent vessels are removed under Scenario 6, and only 6 under Scenario 5. The NEI Team notes that Scenario 6 prioritizes removal of relatively active vessels, so it is not surprising that all latent vessels remain under Scenario 6.
- The average post-buyback closure days (row 6) under an 80,000 m^3 buyback across all scenarios is reduced to 23 days from an average of 43 days with a 40,000 m^3 buyback.
- As shown in row 9, the average over all scenarios of the estimated NOR Gain (exclusive of buyback fees) increases by 119 percent to $241,645 relative to the 40,000 m^3 buyback.
- The average total cost of the buyback over all scenarios increases by 134 percent to $161 million (row 10). This equates to an average of $2,000/$m^3$ of capacity removed (row 11).
- As shown in row 14, the average over all scenarios of the estimated Net NOR Gain (after deducting average buyback fees) increases by 97 percent to $144,621 relative to the 40,000 m^3 buyback.
- The average loan repayment fee per m^3 of remaining capacity is $93/$m^3$, up 180 percent.

Table 32. General Fleetwide Buyback Results by Scenario for the Removal of 80,000 m³ of Capacity

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	$1M Minimum Bid	$2M Minimum Bid	$3M Minimum Bid	Minimum Bid Varies by m³	Variable Min. & Weight by DAS	Variable Min. & Inverse Weighting
	Remove 80,000 m³ of Capacity—Remaining Capacity is ≤ 203,805 m³					
1) Number of Vessels Removed	74	71	55	74	73	56
2) Number of Latent Vessels Removed	28	28	6	28	28	0
3) Number of Active Vessels Remaining	197	200	216	197	198	215
4) Capacity Removed (m³)	80,642	80,048	80,267	81,291	80,175	80,281
5) Capacity Remaining (m³)	203,163	203,757	203,538	202,514	203,630	203,524
6) Estimated Post-Buyback Closure Days	29	31	17	29	33	No Closure
	Increased Revenues After the Buyback Due to Reductions in Closure Days					
7) Estimated Fleetwide Revenue as a Percent of Fleetwide SQ Revenue	94.2%	93.6%	93.7%	94.1%	96.7%	90.2%
8) Estimated Revenue per Remaining Active Vessel as a Percent of SQ	110.6%	110.0%	114.5%	110.8%	109.4%	119.8%
9) Estimated NOR Gain per Active Vessel Exclusive of Buyback Fees	$205,582	$190,627	$282,814	$209,366	$174,611	$386,872
	Repayment of Buyback Loan with Zero Grant Funding: Loan has a 20-year term and 10% interest					
10) Total Vessel Buyback Cost—the Loan Principal Without Interest ($Millions)	$85.52	$126.91	$169.96	$167.58	$199.91	$215.26
11) Cost ($) per m³ of Capacity Removed	$1,060	$1,585	$2,117	$2,061	$2,493	$2,681
12) Total Annual Loan Payment ($Millions)	$10.04	$14.91	$19.96	$19.68	$23.48	$25.28
13) Average Loan Payment ($) per Remaining Active Vessel	$50,988	$74,534	$102,903	$99,919	$118,592	$135,210
14) Net NOR Gains ($) per Active Vessel after Deducting the Buyback Fee	$154,594	$116,093	$179,911	$109,447	$56,019	$251,663
15) Ratio of Net NOR Gains to Annual Fee	3.03	1.56	1.75	1.10	0.47	1.86
16) Loan Repayment Fee as a Percent of Future Annual Revenue	1.2%	1.8%	2.3%	2.3%	2.7%	3.1%
17) Loan Repayment Fee / Remaining m³	$49.44	$73.16	$98.08	$97.20	$115.31	$124.23

The bulleted list below summarizes highlights of the comparison of Table 33 and Table 34

- As seen in row 1, an average (over all scenarios) of 28 Dolphin vessels and 19 FAD vessels are projected to be removed under an 80,000 m³ buyback. The NEI Team notes in the SQ, FAD vessels outnumber Dolphin vessels by 157 to 86. Thus, relatively more Dolphin vessels are removed than FAD vessels. Similarly, more Dolphin vessel capacity (Row 5) is removed on average than FAD vessel capacity despite the fact that under the SQ total FAD vessel capacity is 33 percent higher than Dolphin vessel capacity.
- Row 6 reveals that average FAD vessel total revenue under the buyback is 104 percent of FAD vessel total revenue under the SQ, while Dolphin vessel total revenue under the buyback is 80 percent of total SQ revenue. The difference is attributable to that fact the largest share of FAD vessel revenues come from SKJ, which is unconstrained relative to the SQ, while YFT comprises the largest share Dolphin vessel revenue, and YFT is constrained under the buyback to be less than or equal to YFT harvests under the SQ. Because proportionally more Dolphin vessels are removed than FAD vessels, the Dolphin vessels that remain don't have sufficient YFT catching power to harvest the available YFT in the additional fishing days made available under this buyback option.

The comparison of impacts to FAD vessels and Dolphin vessels of an 80,000 m^3 buyback continues following Table 34.

Table 33. General Results for FAD Vessels of an 80,000 m^3 Buyback

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	$1M Minimum Bid	$2M Minimum Bid	$3M Minimum Bid	Variable Minimum Bid	Variable Min. & Weight by DAS	Variable Min. & Inverse Weighting
Remove 80,000 m^3 of Capacity—Remaining Capacity is ≤ 203,805 m^3						
1) Number of FAD Vessels Removed	20	16	18	19	27	15
2) Number of FAD Vessels Remaining	137	141	139	138	130	142
3) FAD Vessel Capacity Removed (m^3)	29,103	26,417	31,681	27,914	40,317	22,289
4) FAD Vessel Capacity Remaining (m^3)	124,882	127,568	122,304	126,071	113,668	131,696
5) Average Capacity (m^3) / Remaining FAD Vessel	912	905	880	914	874	927
Revenues and NOR After the Buyback but Before Accounting for the Cost of the Buyback						
6) Estimated Total FAD Vessel Revenue as a Percent of SQ Revenue	103.8%	104.0%	105.6%	104.3%	100.9%	107.6%
7) Estimated Revenue / FAD Vessel as a Percent of SQ	111.1%	110.4%	115.1%	111.2%	109.8%	120.8%
8) NOR Gains / Active FAD Vessel	$237,144	$217,542	$316,476	$239,600	$214,660	$422,119
Fleetwide Average Buyback Fees and FAD Vessel NOR After Deducting Fleetwide Average Buyback Fees						
9) Fleetwide Average Payment / Active Vessel (Includes both FAD & Dolphin vessels)	$50,988	$74,534	$102,903	$99,919	$118,592	$135,210
10) NOR Gains / FAD Vessel Net of the Average Buyback Fee	$186,156	$143,008	$213,574	$139,681	$96,069	$286,910
11) Ratio of Annual Net NOR Gains to Annual Fee	3.65	1.92	2.08	1.40	0.81	2.12
Fleetwide Buyback Fees per m^3 and FAD Vessel NOR after Deducting Estimated Buyback Fees						
12) Repayment Fee (using Fleetwide Fee $/ m^3) for the Average FAD Vessel	$45,068	$66,191	$86,299	$88,796	$100,826	$115,217
13) NOR Gains / FAD Vessel Net of the Average Fee per m^3	$192,076	$151,351	$230,177	$150,804	$113,834	$306,902
14) Ratio of Annual Net NOR Gains to Annual Fee per m^3	4.26	2.29	2.67	1.70	1.13	2.66

Table 34. General Results for Dolphin Vessels of an 80,000 m³ Buyback

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	$1M Minimum Bid	$2M Minimum Bid	$3M Minimum Bid	Variable Minimum Bid	Variable Min. & Weight by DAS	Variable Min. & Inverse Weighting
Remove 80,000 m³ of Capacity—Remaining Capacity is ≤ 203,805 m³						
1) Number of Dolphin Vessels Removed	26	27	31	27	18	41
2) Number of Dolphin Vessels Remaining	60	59	55	59	68	45
3) Dolphin Vessel Capacity Removed (m³)	37,361	39,453	45,547	39,199	25,680	57,992
4) Dolphin Vessel Capacity Remaining (m³)	78,281	76,189	70,095	76,443	89,962	57,650
5) Average Capacity (m³) / Remaining Dolphin Vessel	1,305	1,291	1,274	1,296	1,323	1,281
Revenues and NOR After the Buyback but Before Accounting for the Cost of the Buyback						
6) Estimated Total Dolphin Vessel Revenue as a Percent of SQ Revenue	81.7%	80.0%	78.1%	80.9%	91.3%	67.6%
7) Estimated Revenue / Dolphin Vessel as a Percent of SQ	110.9%	110.3%	114.9%	111.1%	109.6%	120.5%
8) NOR Gains / Dolphin Vessel	$156,409	$146,377	$224,053	$159,923	$116,403	$341,637
Fleetwide Average Buyback Fees and Dolphin Vessel NOR After Deducting Fleetwide Average Buyback Fees						
9) Fleetwide Average Payment / Active Vessel (Includes both Dolphin & Dolphin vessels)	$50,988	$74,534	$102,903	$99,919	$118,592	$135,210
10) NOR Gains / Active Dolphin Vessel Net of the Average Buyback Fee	$105,421	$71,843	$121,150	$60,005	($2,188)	$206,428
11) Ratio of Annual Net NOR Gains to Annual Fee	2.07	0.96	1.18	0.60	-0.02	1.53
Fleetwide Buyback Fees per m³ and Dolphin Vessel NOR after Deducting Estimated Buyback Fees						
12) Repayment Fee (using Fleetwide Fee $/m³) for the Average Dolphin Vessel	$64,506	$94,474	$124,999	$125,934	$152,556	$159,155
13) NOR Gains / Dolphin Vessel Net of the Average Fee per m³	$91,904	$51,903	$99,054	$33,989	($36,152)	$182,482
14) Ratio of Annual Net NOR Gains to Annual Fee per m³	1.42	0.55	0.79	0.27	-0.24	1.15

- Notwithstanding total revenue differences seen in row 6, row 7 shows that the gains in average revenue per vessel under the buyback for both FAD vessels and Dolphin vessels are relatively comparable with revenues for Dolphin vessels and slightly higher relative to the SQ.
- Row 8 shows that on average, NOR gains/FAD vessel are higher across all scenarios ($274,590) than average NOR gains/Dolphin vessel ($190,801). These average gains in NOR are more than double NOR gains/vessel under a 40,000 m³ buyback.
- Row 11 shows the ratio of annual NOR gains per vessel (from row 10) relative to the fleetwide average buyback fee from row 9. The average across all scenarios for Dolphin vessels is 1.1:1, while for FAD vessels the average across all scenarios is 2.0:1. The NEI Team notes that while the ratio of net increases in NOR gains is lower with the 80,000 m³ buyback than with the 40,000 m³ buyback, the magnitude of Net NOR gains (Row 10) is larger with an 80,000 m³ buyback.
- Row 14 shows the ratio of the Net NOR gain per vessel from row 13 to the capacity-based loan repayment fee from row 12. The ratio of gains in Net NOR, if loan repayment is based on remaining vessel capacity, is much greater for FAD vessels than for Dolphin vessels.

Table 35 provides additional details about a buyback that removes 80,000 m^3 of capacity, under the six scenarios. Highlights of Table 35 include the following:

- As seen in row 7, all latent vessels are removed under four of the six scenarios, but 22 latent vessels remain a part of the fleet under Scenario 3 and all 28 latent vessels remain under Scenario 6. The latter is expected as Scenario 6 prioritizes removal of vessels with relatively high levels of activity.
- Row 8 shows that unprofitable vessels remain in the fleet under all scenarios—the number of unprofitable vessels is correlated to minimum bid amounts.
- Rows 13 to 15 summarize changes in vessel counts by country type. Under Scenarios 1–4, the relative proportions for each country type remain generally similar to those from the status quo. Under Scenario 5, FAD countries have proportionally fewer vessels in the remaining fleet, and under Scenario 6, FAD countries have proportionally more vessels in the remaining fleet.

Table 35. Additional Details by Scenario for a Buyback Removing 80,000 m^3 of Capacity

Item	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
1) Additional Revenue / Remaining Active Vessels from BET	$43,970	$40,962	$58,820	$44,647	$39,062	$77,014
2) Additional Revenue / Remaining Active Vessels from YFT	$168,076	$153,916	$220,933	$170,370	$162,450	$273,803
3) Additional Revenue / Remaining Active Vessels from SKJ	$204,589	$190,464	$275,513	$207,552	$178,630	$373,469
4) Total Additional Revenue / Remaining Active Vessels	$416,635	$385,342	$555,266	$422,569	$380,142	$724,286
5) NOR / Remaining Active Vessel as a % of SQ	116%	115%	122%	117%	115%	129%
6) Total Number of Active vessels remaining (from 243)	197	200	216	197	198	215
7) Total Number of Latent vessels remaining (from 28)	0	0	22	0	0	28
8) Unprofitable Vessels in the Remaining Active Fleet (from 26)	1	6	7	3	8	7
9) Profitable Vessels in the Remaining Active Fleet (from 217)	196	194	187	194	190	180
10) Vessels Assumed to Sell Out at the Minimum Bid	57	55	41	70	60	34
11) FAD Vessels in the Remaining Active Fleet (from 157)	137	141	139	138	130	142
12) Dolphin Vessels in the Remaining Active Fleet (from 86)	60	59	55	59	68	45
13) Remaining Active Vessels: FAD Vessel Countries (from 143)	123	127	126	124	116	130
14) Remaining Active Vessels: Dolphin Vessel Countries (from 66)	46	45	42	45	50	37
15) Remaining Active Vessels: Mixed Vessel Countries (from 34)	28	28	26	28	32	20

Summary Results for Buybacks that Remove Sufficient Capacity to Eliminate Closure Periods

Table 36 shows the results of buybacks under each scenario that could be expected to completely eliminate the closure periods. Under Scenarios 1–4, the NEI Team estimates that approximately 106,000 m^3 would need to be removed from the fleet to eliminate closure periods. Under Scenario 5, 120,963 m^3 would need to be removed to eliminate closure periods, while under Scenario 6, the NEI Team estimates that only 66,547 m^3 would need to be removed to eliminate closure periods. These differences highlight the fundamentally different approaches to removing vessels that are taken under Scenario 5 and Scenario 6.

The total cost of buybacks that are projected to completely eliminate closure days is relatively high. Over all six of the scenarios, the average total cost of the buyback is $223 million (row 10); or

\$3.6 million/closure day reduction. The average is 39 percent higher than the average total cost of buybacks that remove 80,000 m^3.

If closure days are completely eliminated, the average net NOR gains after deducting average buyback repayment fees (see row 14) across all scenarios equals \$255,655, an increase of 72 percent over a buyback that reduces capacity by 80,000 m^3. In row 15, the average across all six scenarios of the ratio of net NOR gains (row 14) relative to the estimated annual fee (from row 13) is 2.0. This ratio is larger than under the previous buyback, and double the average estimated cost of the buyback.

Row 16 shows the average loan repayment fee as a percentage of expected future annual revenue. The average over all six scenarios is 3.1 percent, an increase of 39 percent relative to an 80,000 m^3 buyback.

The average over all the scenarios of average loan payment per remaining m^3 of capacity increases by 59 percent to \$148/m^3 from \$93/m^3 under the 80,000 m^3 buyback.

Table 36. General Fleetwide Results from Buyback Scenarios that Result in Elimination of Closure Periods

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	\$1M Minimum Bid	\$2M Minimum Bid	\$3M Minimum Bid	Minimum Bid Varies by m^3	Variable Min. & Weight by DAS	Variable Min. & Inverse Weighting
Remove Enough Capacity to Completely Eliminate Closure Days						
1) Number of Vessels Removed	90	92	88	90	103	46
2) Number of Latent Vessels Removed	28	28	28	28	28	0
3) Number of Active Vessels Remaining	181	179	183	181	168	225
4) Capacity Removed (m^3)	104,083	110,618	107,762	104,083	120,963	66,547
5) Capacity Remaining (m^3)	179,722	173,187	176,043	179,722	162,842	217,258
6) Estimated Post-Buyback Closure Days	No Closure	No Closure	No Closure	No Closure	No Closure	No Closure
Increased Revenues After the Buyback Due to Reductions in Closure Days						
7) Estimated Fleetwide Revenue as a Percent of Fleetwide SQ Revenue	94.9%	92.8%	93.4%	94.9%	92.3%	95.5%
8) Estimated Revenue per Remaining Active Vessel as a Percent of SQ	109.2%	108.3%	101.8%	109.1%	106.6%	118.5%
9) Estimated NOR Gain per Active Vessel Exclusive of Buyback Fees	\$403,509	\$408,233	\$395,312	\$403,509	\$423,550	\$330,129
Repayment of Buyback Loan with Zero Grant Funding: Loan has a 20-year term and 10% interest						
10) Total Vessel Buyback Cost—the Loan Principal Without Interest (\$Millions)	\$148.22	\$215.80	\$256.60	\$229.76	\$327.69	\$161.91
11) Cost (\$) per m^3 of Capacity Removed	\$1,424	\$1,951	\$2,381	\$2,207	\$2,709	\$2,433
12) Total Annual Loan Payment (\$Millions)	\$17.41	\$25.35	\$30.14	\$26.99	\$38.49	\$19.02
13) Average Loan Payment (\$) per Remaining Active Vessel	\$96,185	\$141,610	\$164,699	\$149,100	\$229,107	\$96,537
14) Net NOR Gains (\$) per Active Vessel after Deducting the Buyback Fee	\$307,325	\$266,623	\$230,613	\$254,409	\$194,444	\$280,514
15) Ratio of Net NOR Gains to Annual Fee	3.20	1.88	1.40	1.71	0.85	2.91
16) Loan Repayment Fee as a Percent of Future Annual Revenue	2.0%	3.0%	3.6%	3.1%	4.6%	2.2%
17) Loan Repayment Fee / Remaining m^3	\$96.87	\$146.36	\$171.21	\$150.16	\$236.36	\$87.54

Table 37 (for FAD vessels) and Table 38 (for Dolphin vessels) summarize the impact of buybacks that remove enough capacity such that the closure periods can be reduced to zero. Under the buyback option that eliminates all closure days, the positive impacts to Dolphin vessels are still greater than the costs of the buyback, but the margins are lower compared to FAD vessels. In row 10, Dolphin vessels generate an average Net NOR Gain of $183,312, while FAD vessels generate an average Net NOR Gain of $307,913. For Dolphin vessels, the average across all scenarios of the ratio of Net NOR Gain to the average cost per vessel of the buyback (Row 11) is 1.5:1; for FAD vessels the ratio is 2.0:1. As shown in Row 14 for Dolphin vessels, the average over all scenarios of the Net NOR Gain ratio if the buyback loan fee is assessed based on the m^3 of remaining capacity, is 0.93:1. Dolphin vessels would still be able to pay back the buyback loan and increase NOR, but the gains are not as high as for FAD vessels (2.9:1).

The reason behind lower positive benefits for Dolphin vessels is that the amount of capacity reduction necessary to eliminate closure days for YFT is much less than the amount of capacity reduction necessary to eliminate closure days for BET. Therefore, after additional capacity is removed to reduce BET harvest, the Dolphin vessels that remain do not have enough catching power or days in the year to harvest the YFT available to them.

A careful review of the data driving the results indicates that the closure period on YFT could be eliminated with a capacity reduction of 56,347 m^3 under Scenario 2. An additional 55,000 m^3 of capacity must be removed to keep BET from being overharvested. Additional discussion of this issue is provided in 4.2.1.3 beginning on page 100.

Table 37. General Results for FAD Vessels of a Buyback That Eliminates Closure Days

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	$1M Minimum Bid	$2M Minimum Bid	$3M Minimum Bid	Variable Minimum Bid	Variable Min. & Weight by DAS	Variable Min. & Inverse Weighting
Remove Enough Capacity to Eliminate Closure Days						
1) Number of FAD Vessels Removed	28	28	25	28	37	12
2) Number of FAD Vessels Remaining	129	129	132	129	120	145
3) FAD Vessel Capacity Removed (m^3)	41,138	44,627	42,551	41,138	52,992	18,030
4) FAD Vessel Capacity Remaining (m^3)	112,847	109,358	111,434	112,847	100,993	135,955
5) Average Capacity (m^3) / Remaining FAD Vessel	875	848	844	875	842	938
Revenues and NOR After the Buyback but Before Accounting for the Cost of the Buyback						
6) Estimated Total FAD Vessel Revenue as a Percent of SQ Revenue	107.6%	105.7%	106.6%	107.6%	105.3%	109.2%
7) Estimated Revenue / FAD Vessel as a Percent of SQ	120.8%	120.8%	121.2%	120.8%	120.8%	120.8%
8) NOR Gains / Active FAD Vessel	$462,358	$455,073	$460,665	$462,358	$482,445	$415,946
Fleetwide Average Buyback Fees and FAD Vessel NOR After Deducting Fleetwide Average Buyback Fees						
9) Fleetwide Average Payment / Active Vessel (Includes both FAD & Dolphin vessels)	$96,185	$141,610	$164,699	$149,100	$229,107	$96,537
10) NOR Gains / FAD Vessel Net of the Average Buyback Fee	$366,173	$313,488	$281,813	$313,258	$253,338	$319,409
11) Ratio of Annual Net NOR Gains to Annual Fee	3.81	2.21	1.71	2.10	1.11	3.31
Fleetwide Buyback Fees per m^3 and FAD Vessel NOR after Deducting Estimated Buyback Fees						
12) Repayment Fee (using Fleetwide Fee $/$m^3$) for the Average FAD Vessel	$84,739	$124,078	$144,533	$131,358	$198,926	$82,075
13) NOR Gains / FAD Vessel Net of the Average Fee per m^3	$377,619	$331,021	$301,979	$331,000	$283,519	$333,871
14) Ratio of Annual Net NOR Gains to Annual Fee per m^3	4.46	2.67	2.09	2.52	1.43	4.07

Table 38. General Results for Dolphin Vessels of a Buyback That Eliminates Closure Days

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
	$1M Minimum Bid	$2M Minimum Bid	$3M Minimum Bid	Variable Minimum Bid	Variable Min. & Weight by DAS	Variable Min. & Inverse Weighting
Remove Enough Capacity to Eliminate Closure Days						
1) Number of Dolphin Vessels Removed	34	36	35	34	38	34
2) Number of Dolphin Vessels Remaining	52	50	51	52	48	52
3) Dolphin Vessel Capacity Removed (m^3)	48,767	51,813	51,033	48,767	53,793	48,517
4) Dolphin Vessel Capacity Remaining (m^3)	66,875	63,829	64,609	66,875	61,849	67,125
5) Average Capacity (m^3) / Remaining Dolphin Vessel	1,286	1,277	1,267	1,286	1,289	1,291
Revenues and NOR After the Buyback but Before Accounting for the Cost of the Buyback						
6) Estimated Total Dolphin Vessel Revenue as a Percent of SQ Revenue	79.0%	76.2%	77.1%	79.0%	75.7%	77.9%
7) Estimated Revenue / Dolphin Vessel as a Percent of SQ	120.5%	120.5%	120.5%	120.5%	120.5%	120.5%
8) NOR Gains / Dolphin Vessel	$328,609	$331,340	$322,172	$328,609	$339,603	$326,780
Fleetwide Average Buyback Fees and Dolphin Vessel NOR After Deducting Fleetwide Average Buyback Fees						
9) Fleetwide Average Payment / Active Vessel (Includes both Dolphin & Dolphin vessels)	$96,185	$141,610	$164,699	$149,100	$229,107	$96,537
10) NOR Gains / Active Dolphin Vessel Net of the Average Buyback Fee	$232,425	$189,729	$157,473	$179,509	$110,496	$230,243
11) Ratio of Annual Net NOR Gains to Annual Fee	2.42	1.34	0.96	1.20	0.48	2.39
Fleetwide Buyback Fees per m^3 and Dolphin Vessel NOR after Deducting Estimated Buyback Fees						
12) Repayment Fee (using Fleetwide Fee $/$m^3$) for the Average Dolphin Vessel	$124,579	$186,845	$216,893	$193,115	$304,560	$112,997
13) NOR Gains / Dolphin Vessel Net of the Average Fee per m^3	$204,031	$144,495	$105,279	$135,494	$35,043	$213,783
14) Ratio of Annual Net NOR Gains to Annual Fee per m^3	1.64	0.77	0.49	0.70	0.12	1.89

Table 39 provides additional details about a buyback that removes sufficient capacity to eliminate closure days under all scenarios.

Table 39. Additional Details of Buyback Scenarios that Result in Elimination of Closure Periods

Item	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
1) Additional Revenue / Remaining Active Vessels from BET	$82,879	$83,807	$81,688	$82,879	$88,362	$75,628
2) Additional Revenue / Remaining Active Vessels from YFT	$314,108	$308,037	$302,943	$314,108	$327,717	$285,069
3) Additional Revenue / Remaining Active Vessels from SKJ	$388,536	$391,000	$382,829	$388,536	$411,608	$368,023
4) Total Additional Revenue / Remaining Active Vessels	$785,524	$782,843	$767,459	$785,524	$827,687	$728,720
5) NOR / Remaining Active Vessel as a % of SQ	138%	139%	137%	138%	140%	130%
6) Total Number of Active vessels remaining (from 243)	181	179	183	181	168	197
7) Total Number of Latent vessels remaining (from 28)	0	0	0	0	0	28
8) Unprofitable Vessels in the Remaining Active Fleet (from 26)	0	2	4	0	0	9
9) Profitable Vessels in the Remaining Active Fleet (from 217)	181	177	179	181	168	188
10) Vessels Assumed to Sell Out at the Minimum Bid	58	61	67	75	76	31
11) FAD Vessels in the Remaining Active Fleet (from 157)	129	129	132	129	120	145
12) Dolphin Vessels in the Remaining Active Fleet (from 86)	52	50	51	52	48	52
13) Remaining Active Vessels: FAD Vessel Countries (from 143)	116	116	119	116	107	133
14) Remaining Active Vessels: Dolphin Vessel Countries (from 66)	39	37	38	39	34	39
15) Remaining Active Vessels: Mixed Vessel Countries (from 34)	26	26	26	26	27	25

4.2.1.3 Further Discussion Regarding the Buybacks that would Eliminate Closure Periods

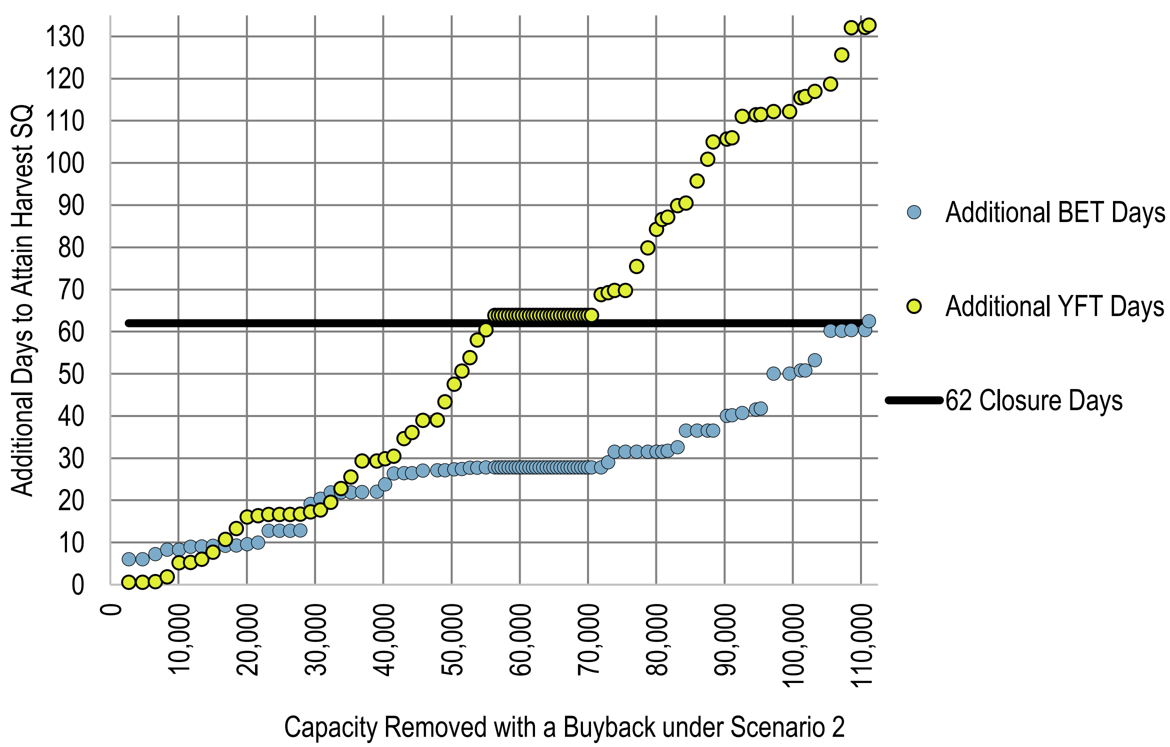
The NEI Team believes that the conclusion that excess YFT capacity is removed under the buyback scenarios that eliminate closure periods is an important finding. The NEI Team also believes that this is a finding that could, at least in theory, be resolved in an actual buyback program through careful and purposeful selection of vessels for removal.

Figure 53 on the following page provides the background information needed to demonstrate the issue. In the figure, each vessel as it is bought out of the fishery is represented by two vertically aligned dots—a yellow dot and a blue dot. The yellow dot represents the cumulative number of YFT closure days that can be eliminated with the removal of the vessel, while the blue dot represents cumulative number of BET closure days that can be eliminated. The first vessel that is removed clearly catches more BET than YFT—with its removal ≈ 6 BET closure days can be eliminated as well as 0.5 YFT closure days. With the fifth vessel a cumulative total of 10,000 m^3 will have been removed and the reduction in the BET closure days is 9, while the reduction in YFT closure day is just 5. Removal of the next six vessels brings the cumulative capacity reduction to 20,000 m^3, and the cumulative reduction in YFT closure days to 16, while BET closure remains at 10 days. As successive vessels are removed up to a cumulative reduction of 40,000 m^3 of capacity, BET and YFT closure day reductions are approximately equal.

As the buyback continues beyond 40,000 m^3, however, closure day reductions for BET are nearly flat while closure day reductions increase sharply for YFT. At 56,347 m^3, closure day reductions hit 62 days for YFT, but remain at 28 days for BET. The flat portion of the closure day plots for both species begins coincidentally at this same level of capacity reductions and continues through removal of the sixty-fourth vessel and removal of 72,000 m^3 of capacity. These flat portions of the plots demonstrate the impact of the removal of latent vessels—their removal has no immediate impact on reducing closure days, but does increase the cumulative capacity removed. After the last latent vessel is removed, additional capacity reductions further reduce YFT catching power relative to BET catching power, as demonstrated by the divergence of theoretical closure day reductions. Finally, with removal of the ninety-third vessel and a cumulative reduction of 111,160 m^3 in capacity, the BET closure day reduction crosses the 62-day line.

In an actual buyback, assuming the Buyback Authority is provided with complete catch histories of all vessels that submit bids, the ranking of vessels for removal could be done in a way that maintains the parity between BET and YFT closure day reductions. If this is done effectively, then reductions in closure days for BET and for YFT could occur at the same level of capacity removal or at the relative levels required to address the IATTC's conservation objectives.

Figure 53. Additional Fishing Days Available with Capacity Reductions under Scenario 2



4.2.1.4 Caveats Regarding Potential Benefits of Buybacks

The NEI Team has estimated the potential benefits of the buyback from the perspective of the remaining fleet as a whole and not on a vessel-by-vessel basis, as was done in the assessment of the costs of overcapacity. In practice, this means that the methodology used to estimate closure day reductions places less importance on the fact that fishing effort is quite lumpy, and that all vessels will not be able to proportionally increase their effort and catch with reductions in closure days. The methodology also ignores our conclusions from the assessment of the costs of overcapacity that some individual vessels might be constrained from taking additional trips even if the closures were eliminated. (See Table 14 and the related discussion.)

Vessels that are likely to benefit most from any buyback are vessels that have latent capacity. These could include vessels that continue to be in the Register after the buyback that have not participated in the past. Vessels with latent capacity could also include vessels that are not operating on a full-time basis. Vessels with relatively low levels of activity that remain part of the fleet after the buyback is completed have the greatest potential to gain from the buyback. Conversely, vessels that are currently participating at or near maximum levels will have less potential to benefit financially from the buyback. If a buyback occurs, then all vessels will benefit from the reduced threat of additional closure days and the likelihood that stocks are more likely to be management sustainably.

Other caveats

- Vessels that are fishing in both the EPO and WCPO, and that are fully utilized, could increase their fishing days in the EPO but only at the expense of decreasing fishing days in the WCPO. While this would represent an increase in effort and revenue in the EPO, the NOR for the vessel would probably not increase proportionally.
- Vessels that are already deemed to be constrained in the EPO fishery even if there were no closures (as described on Table 14 and footnote 12 on page 57) are unlikely to be able to realize the proportional gains in fishing days that other less constrained vessels could realize. For these vessels, the added revenue potential may not be as likely to cover the buyback repayment fees.

Repayment of Loans

The NEI Team notes that there are multiple options for assessing repayment fees. The NEI Team assumes that the loan will be paid back with a flat percentage tax/fee on gross revenues for all vessels. Remaining vessels that choose not to participate would not have to pay the buyback tax/fee. If latent vessels choose not to participate, then it is more likely that participating vessels will reap the benefits of fewer closure days that result from the buyback.

An alternative way to pay back the buyback loan would be to charge a flat fee for each cubic meter of capacity in the Register for all remaining vessels regardless of the vessel's level of participation. This type of repayment schedule would likely provide more certainty with respect to the repayment of the loan and could result in lower interest rates. However, the NEI Team believes a fixed fee per m^3 for all remaining vessels would be more likely to encourage authorized/latent vessel that remain in the fleet to enter the fishery, and it would also further encourage active vessels that have not been fishing up to their full capacity to disproportionately increase their effort relative to the reduction in closure days.

4.2.1.5 Maintenance of Country Level Capacity Rights under a Buyback Program

In the introduction to the assessment of the buyback program, the NEI Team assumes that the IATTC, through the Vessel Buyback Authority established for this purpose, CPCs, and vessel owners will agree in advance to implement the buyback program. Of particular importance within that agreement is a statement that all parties agree that once capacity is removed from the Register as a result of a buyback, the capacity will not re-issued or authorized. Without such an agreement, it is unlikely that funding agencies and banks would provide financial support for a buyback, nor is it likely that vessel owners would commit to participate. This issue was a major point of discussion during recent meetings with vessel owners. Industry members asked:

> If there is a buyback, what will prevent countries that have given up capacity from simply going back to the IATTC and requesting that additional capacity be added back into the fishery?

Clearly a pre-buyback binding agreement between the Buyback Authority, CPCs, and vessel owners is a precursor to a successful buyback program.[30] The question being asked by industry members concerns the motivation of individual CPCs, particularly CPCs that wish to increase their level of participation in the fishery—*why would these CPCs agree to a vessel buyback?* One potential way to facilitate an agreement across all CPCs to honor the buyback may be found in the concept of capacity transfers as discussed in the example below.

Assume, for example, that prior to the buyback, Countries A, B, C all have capacity in the fishery. Country A controls 50 percent of the capacity; Country B controls 35 percent of the capacity, and Country C controls the remaining 15 percent of the capacity. Countries A and B are both in favor of the buyback because they recognize that their fishing vessels are suffering because of excess capacity. Country C refuses to agree to the buyback because it wants to maintain or increase its current level of capacity and believes it will likely lose capacity relative to Countries A and B. To convince Country C to agree to the Buyback, Countries A and B agree that within one year following the buyback, all Countries will transfer capacity among themselves, such that the pre-buyback percentage share of capacity among the Countries is achieved or modified in a way that C can agree to. The NEI Team notes that in this example it is assumed that the post buyback transfers are accomplished in a way that would be amenable to remaining vessel owners.

4.2.2 IATTC Member States Commit to Reduce Authorized Capacity by 10 Percent per Year and Freeze that Capacity until Fleet Capacity is Reduced

The 10 Percent per Year Reduction Program (or 10-Percent Program for short), has been adapted from a proposal from the European Union formally presented to the IATTC at its 87th Meeting in July 2014.[31] For purposes of analysis, the assessment of the 10-Percent Program assumes the following programmatic guidelines:

1) All countries agree in advance to follow the protocols of the program for a period of no less than five years.
2) Under this program all vessels that are currently listed as **Inactive** or **Sunk** in the IATTC Register will maintain that same status for the duration of the program.
3) For purposes of this program …
    a. an **authorized** vessel is a purse seine vessel in the IATTC Register that is neither **Inactive** nor **Sunk**, regardless of whether it actually landed tuna in the EPO during the most recent fishing year.
    b. an **active** vessel is a vessel that landed tuna from the EPO in the most recent year of fishing.
    c. For purposes of this program, a **latent** vessel is a vessel that is **authorized** with respect to the IATTC Register, but which did not land tuna from the EPO in the most recent year of fishing.
4) Under this program (as analyzed), the U.S. agrees to prohibit vessels from fishing in the EPO under paragraph 12 exemption in IATTC Resolution C-02-03. Any other country that could utilize this

[30]The NEI notes the individual CPCs could also enact domestic legislation to provide additional security and regulations to implement agreements associated with a buyback.

[31] A revised version of the proposal was presented to the 88th meeting of the IATTC in October 2014. The proposal text is available at https://www.iattc.org/Meetings/Meetings2014/Oct-Nov/_English/IATTC-87-PROP-H-2A-EU-Management-of-fishing-capacity.pdf.

exemption also agrees that none of its vessels will utilize the exemption during the five years of the 10-Percent Program.

5) All countries with 10 or more **authorized** vessels in the fishery will participate in the program.

6) Countries with fewer than 10 **authorized** vessels will also participate, but they will only remove their **latent** vessels as defined above.

7) Removal of vessels will be temporary. Temporary removal implies that the vessel's status on the IATTC Register will be changed to **Inactive** for the duration of the Program.

8) For purposes of this assessment, Year 0 is the year prior to implementation of the program. Functionally Year 0 = 2016.

9) Prior to the beginning of Year 1 of the program, the following will occur:

    a. All countries will redesignate all vessels that were **latent** in Year 0 as **Inactive** in the IATTC Register. If the number of **latent** vessels that are redesignated is more than 10 percent of that country's **authorized** vessels from Year 0, then no further action is required of that country in Year 1.

    b. Any country with 10 or more **authorized** vessels in Year 0 will redesignate additional vessels (i.e. vessels that were **active** in Year 0) such that the sum of redesignated **latent** and redesignated **active** vessels = 10 percent of the country's **authorized** vessels from Year 0.

    Note that countries will be advised to round-down to the nearest whole vessel when calculating the total number of vessels that they will need to redesignate. For example, if a country has 37 **authorized** vessels in Year 0, they will be asked to redesignate 3 vessels in Year 1, 3 vessels in Year 2, and 3 vessels in Year 3.

    Note also that countries have the freedom to choose which of their flagged active vessels to redesignate as Inactive.

    c. By the end of the first quarter in Year 1, IATTC staff will calculate the reduction in closure days that will be necessary for Year 1, based on the vessels that have been redesignated.

10) Prior to the beginning of Year 2 of the program, the following will occur:

    a. All countries that had 10 or more **active** vessels in the fishery will redesignate 10 percent of their **active** vessels (after rounding down to the nearest whole vessel) as **Inactive** in the IATTC Register.

    b. Countries have the freedom to choose which vessels they wish to redesignate.

    c. If a country wishes, they may reactivate previously Inactive vessels as long as the total number of redesignated vessels equals their Year 1 + Year 2 requirements. In other words, if a country redesignated two vessels in Year 1 and is required to redesignate a third vessel in Year 2, it could, if it chooses, re-activate the two vessels from Year 1 and redesignate a total of three other vessels in Year 2.

    d. Countries with fewer than 10 vessels need take no further action, noting that the number of redesignated vessels must remain the same in all future years.

    e. The IATTC staff will calculate the reduction in closure days that will be necessary for Year 2 based on the vessels that have been redesignated by the end of the first quarter in Year 2.

11) Prior to the beginning of Year 3 of the program, the same protocols used Year 2 will be followed, with the exception described below:

a. If in Year 2, the IATTC staff estimated that enough capacity had been removed so that closure periods could be eliminated completely, then no further reductions will be required.

b. As in Year 2, countries will be allowed to reactivate previously Inactive vessels as long as the total number of redesignated vessels equals their Year 1 + Year 2 + Year 3 requirements.

12) Years 4 and 5 will follow the same protocols as Year 3.

13) During Year 5, the program will be re-evaluated, and the IATTC could choose to extend the program, modify the program, or eliminate the program.

4.2.2.1 Quantitative Assessment of a 10 Percent per Year Reduction Program

The NEI Team has developed a quantitative assessment of the 10-Percent Program that follows the protocols outline above. The assessment uses the 2016 fishing as Year 0. In 2016 there were 237 active vessels and 37 latent vessels. In the assessment, each flag state is treated separately, but in order to preserve confidentiality, the results are reported in terms of FAD countries, Dolphin countries, and Mixed countries. In 2016 there were five participating FAD countries including Ecuador and the U.S.; three participating Dolphin countries including Mexico and Venezuela; and three participating Mixed countries including Columbia and Panama.

In this assessment the NEI Team includes only vessels that were active in 2016 but assigns each vessel's average catch from 2014 to 2016 to represent its future year harvests. The NEI Team also assumes the sum of these catches represents a sustainable harvest for the primary tuna species (BET, YFT and SKJ).

One of the key features of the assessment is the calculation of closure days in each year of the program. The estimation of the reduction in closure days uses the same principles used to calculate closure day reductions under the Buyback Program as described at the beginning of Section 4.2. Specifically, we estimate the number of days the remaining fleet will need to catch the harvest that were foregone by vessels that have been removed from the fishery (i.e. redesignated), given the catch/day of the remaining fleet. Each time a vessel is redesignated the catch per day of the remaining fleet changes. If the vessel that was redesignated is a "low profit" vessel then it is likely that the catch per day of the remaining fleet increases, because it is likely that the low profit vessel had lower catch rates than the higher profit vessels that remain. If it is estimated that the remaining fleet can catch the harvests foregone by vessels that have been redesignated in fewer than 62 days, then then closure period will be reduced but not eliminated. If it is estimated that the remaining fleet will require more than 62 days to catch the foregone harvests of the redesignated vessels, then overall harvests will decline relative to the status quo. In this situation the individual members of the remaining fleet will all be better off, but processors and consumers will have less product than they might have had otherwise. Further, if "too many" vessels have been removed, the IATTC staff is presumed to notify one or more CPCs that redesignated additional vessels in that year, that they can redesignate one less vessel in the year that follows.

As with the buyback program the assessment of impacts of the 10-Percent Program assume that vessels in the remaining fleet do not expand effort disproportionately. For example, a vessel that took four 40-day trips during the year would be able to take one more trip if the closure periods were eliminated, but it is assumed that it will not disproportionately increase its effort and take two additional trips.

The results of the 10-Percent Program are summarized in Table 40 for Year 0 and each of the next four years. With the reductions from Year 4, the NEI Team estimates that the closure period can be eliminated completely, and thus no further reductions would be required in Year 5. By Year 4, a total of 86 vessels will have been redesignated 34 of which were latent in 2016 and 52 of which were active. Authorized capacity in the fleet will have been reduced from 283,805 m^3 in Year 0 to 202,607 m^3 in Year 4. Net operating revenues (NOR) per active vessel is estimated to increase to an average of $1.77 million from $1.06 million in Year 0. Highlights of each year are summarized in the bulleted list below:

- In Year 1: 48 Redesignated Vessels; Authorized capacity = 242,050 m^3; Closure Days = 50; Average NOR/vessel up $171,394 relative to Year 0.
- In Year 2: 66 Redesignated Vessels; Authorized capacity = 224,353 m^3; Closure Days = 30; Average NOR/vessel up $402,293 relative to Year 0.
- In Year 3: 48 Redesignated Vessels; Authorized capacity = 260,673 m^3; Closure Days = 5; Average NOR/vessel up $671,622 relative to Year 0.
- In Year 4: 48 Redesignated Vessels; Authorized capacity = 260,673 m^3; Closure Days = 0; Average NOR/vessel up $703,870 relative to Year 0.

Table 40. Year by Year Results of the 10-Percent Program

	FAD Countries	Dolphin Countries	Mixed Countries	All Countries & Fleets
Status Quo: Includes 34 latent vessels and 237 active vessels; The closure period is 62 days				
Registered Vessels	159	67	45	271
Active Vessels	138	65	34	237
Latent Vessels	21	2	11	34
Registered Capacity (m^3)	148,759	84,430	50,616	283,805
Active Capacity (m^3)	134,472	83,069	43,132	260,673
Latent Capacity (m^3)	14,287	1,361	7,484	23,132
Revenue/Vessel ($Millions)	$3.3	$4.6	$4.9	$3.9
Total Revenue ($Millions)	$459.8	$297.8	$168.2	$925.9
Net Operating Revenue per Active Vessel ($Millions)	$1.41	$0.55	$0.63	$1.06
Year 1: All 34 latent plus 14 active vessels are removed; The closure period is reduced to 50 days				
Active Vessels	129	61	33	223
Inactive/Latent Vessels	30	6	12	48
Active Capacity (m^3)	123,370	77,028	41,652	242,050
Active Capacity as a Pct of SQ	83%	91%	82%	85%
Revenue/Active Vessel ($Millions)	$3.6	$4.8	$5.2	$4.2
Revenue/Active Vessel: Pct of SQ	107.5%	105.7%	104.3%	106.5%
Total Revenue: Pct of SQ	100.5%	99.2%	101.2%	100.2%
Net Operating Revenue per Active Vessel ($Millions)	$1.63	$0.65	$0.75	$1.23
Year 2: All 34 latent plus 32 active vessels are removed; The closure period is reduced to 30 days				
Active Vessels	118	56	31	205
Inactive/Latent Vessels	41	11	14	66
Active Capacity (m^3)	114,412	70,219	39,563	224,194
Active Capacity as a Pct of SQ	77%	83%	78%	79%
Revenue/Active Vessel ($Millions)	$4.0	$5.2	$5.6	$4.6
Revenue/Active Vessel: Pct of SQ	120.0%	114.3%	112.3%	117.0%
Total Revenue: Pct of SQ	102.6%	98.5%	102.4%	101.2%
Net Operating Revenue per Active Vessel ($Millions)	$1.92	$0.82	$0.91	$1.47

	FAD Countries	Dolphin Countries	Mixed Countries	All Countries & Fleets
Year 3: All 34 latent plus 49 active vessels are removed; The closure period is reduced to 5 days				
Active Vessels	108	51	29	188
Inactive/Latent Vessels	51	16	16	83
Active Capacity (m^3)	108,055	62,483	36,689	207,227
Active Capacity as a Pct of SQ	73%	74%	72%	73%
Revenue/Active Vessel ($Millions)	$4.4	$5.5	$5.9	$4.9
Revenue/Active Vessel: Pct of SQ	131.8%	121.0%	118.9%	126.4%
Total Revenue: Pct of SQ	103.2%	94.9%	101.4%	100.2%
Net Operating Revenue per Active Vessel ($Millions)	$2.18	$1.00	$1.11	$1.69
Year 4: All 34 latent plus 52 active vessels are removed; The closure period is reduced to 0 days				
Active Vessels	106	50	29	185
Inactive/Latent Vessels	53	17	16	86
Active Capacity (m^3)	105,251	61,125	36,689	203,065
Active Capacity as a Pct of SQ	71%	72%	72%	72%
Revenue/Active Vessel ($Millions)	$4.5	$5.6	$6.0	$5.0
Revenue/Active Vessel: Pct of SQ	133.8%	123.2%	121.7%	128.7%
Total Revenue: Pct of SQ	102.8%	94.8%	103.8%	100.4%
Net Operating Revenue per Active Vessel ($Millions)	$2.24	$1.05	$1.16	$1.75

One of the more interesting findings from the 10-Percent Program is that for each reduction in authorized capacity the reduction in closure days is higher than the reduction in closure days achieved in the Buyback Program. Part of the difference is due to the fact that the starting points of the two programs vary. Under the Buyback Program the NEI Team included 243 vessels that were active in either 2015 or 2016 as the "Status Quo" fleet while under the 10-Percent Program only the 237 vessels from 2016 were considered part of the "Status Quo" fleet. This means that Status Quo fleet under the 10-Percent Program had less catching power than the Status Quo Fleet in the Buyback Program.

Another important factor contributing to the apparently better performance of 10-Percent Program in reducing closure days is the fact that the proportion of Dolphin vessels that are redesignated is approximately equal to the proportion of FAD vessels that are redesignated. Recall from Figure 23 on page 27, that Dolphin vessels catch virtually zero BET, while FAD vessels catch BET and YFT in approximately equal proportions. Thus, redesignating Dolphin vessels and FAD vessels in equal proportions leaves the remaining fleet with approximately the same ability to catch both BET and YFT as in the Status Quo. Under the Buyback Program, relatively more Dolphin vessels were being removed than FAD vessels, which in turn means that the ability of the remaining fleet to catch YFT was decreasing faster than the ability of the remaining fleet to catch BET. The disproportionate removal of Dolphin vessels under the Buyback Program means that even more vessels had to be removed from the fleet to reduce the BET catching power of the remaining fleet to levels that would allow the elimination of the closure periods.

The proportional redesignation of Dolphin vessels and FAD vessels also leads to the much greater increases in the average NOR/vessel estimated under the 10-Percent Program relative to per vessel increases in NOR under the Buyback Program. This is due primarily higher expected catches of YFT relative to expected catches under the Buyback Program. Under Scenarios 1–4 of the Buyback Program with capacity reductions sufficient to eliminate closure days, the remaining fleet was estimated to catch only 92 percent of Status Quo YFT harvest; in Year 4 of 10-Percent Program catches of YFT are expected to be at least 97 percent of YFT harvests under the Status Quo. It must be said however that under the 10-Percent Program expected harvests of BET are down 6 percent relative to expected harvests under status quo and under the Buyback Program. This lost revenue for FAD vessels is more than offset by under the 10-Percent Program by increased revenues for FAD vessels from SKJ and YFT.

4.2.3 Voluntary Single Country Capacity Reduction Pilot Programs

These voluntary capacity reduction programs are based on the premise that a flag state with large capacity holdings could voluntarily reduce its capacity enough that its remaining vessels would receive a reduction in their closure days appropriate to its reduction in capacity. This type of single country program would need the approval of all IATTC voting members to move forward—unilateral capacity reductions would certainly be welcomed, but without full approval of the IATTC, CPCs choosing to reduce capacity would not receive exemptions from the closure periods.

For purposes of this analysis, the NEI Team has assumed that both Ecuador and Mexico—because they are the two largest players in terms of operative capacity—choose to develop similar pilot programs for a period of 5 years. It is also assumed that that both countries choose to idle sufficient operative capacity at the beginning of the period that the remainder of their fleets can fish without closure days for the 5-year duration of the pilot programs. The vessels that each country chooses to idle will be redesignated as "Inactive" on the IATTC register. The NEI Team also assumes that the programs are financed by upfront payments made by the remaining vessels using a fixed fee per m^3 of capacity.

In order to protect the confidentiality of individual vessels and specific countries, the NEI team has developed "Pseudo-Fleets" for Ecuador and Mexico. The Pseudo-Ecuador fleet is comprised of similar but slightly higher numbers of vessels with slightly higher levels of total capacity as the actual fleet from Ecuador.[32] The Pseudo-Ecuador fleet includes 116 vessels with capacity of 96,568 m^3, including 99 Ecuadorian flagged vessels. The Pseudo-Mexico fleet includes 50 vessels with a capacity of 61,925 m^3 including 40 Mexican flagged vessels.

Other key assumptions used in the assessments of these pilot programs are:

- The National Fisheries Organization (NFO) for each country will manage the programs and will commit to the IATTC that they and their vessels will comply with IATTC stipulations approving the Pilot Programs.
- Prior to the beginning of the fishing year, each vessel in the Pseudo-fleets will be invited by the NFO to submit a bid indicating the minimum amount they are willing to accept to be "redesignated" as Inactive in the IATTC Register for the upcoming year only.
- The NFO will rank the bids using one of the same six bid ranking scenarios described under the vessel buyback program. (See Section 4.2.1.1 starting on page 78 for a full description of Scenarios 1–6).
- The NEI Teams assumes for purposes of analysis that the bids that are submitted are identical each year. In reality, it is believed that some vessels that were not selected but wished they had been will alter their bid in subsequent years. Similarly, vessels that were redesignated but wish they hadn't been are likely to alter their bids in subsequent years.
- The NFO will redesignate sufficient numbers of vessels and capacity such that IATTC staff will, after a formal review—assumed to have been built into the Pilot Program Agreements—eliminate closure periods for the fleet for the upcoming year.

[32] The NEI Team made the decision that the Pseudo-fleets would have slightly higher levels of capacity in order to ensure the confidentiality of actual data about the two country's actual fleets, but that the proportional split between FAD vessels and Dolphin vessels would be maintained.

- The NFO will then collect fees from the active vessels remaining in the fleet to cover the that year's costs. It is assumed that fees will be a flat rate per m^3.

Table 41 and Table 42 show the estimated results of the two pilot programs. The differences between the two programs are noteworthy, as are the difference between these two single-country programs and the results of the fleet-wide buyback program as summarized in Table 36. First, the total number of vessels that would be removed for the two pilot programs combined (≈30 vessels) is approximately 35 percent of the number of vessels that would need to be removed under the fleetwide buyback, despite the fact that the two Pseudo-fleets comprise over 65 percent of entire 271-vessel Registered EPO fleet. The reason that so few vessels need to be removed is due primarily to the fact that there are no latent vessels that need to be removed.

Another key finding is seen in the estimated costs of the three programs. If measured in terms of annual repayment fees per m^3 (Row 12) that would be charged to the remaining fleet, the Pseudo-Ecuador fleet would pay $124/$m^3$ under Scenario 3, while the Pseudo-Mexico fleet would pay just $62/$m^3$ under their pilot program. Under the fleetwide buyback, the annual fee per m^3 under Scenario 3 would be $148/$m^3$.

The difference can be attributed to difference in the harvesting patterns between the Pseudo-Ecuador fleet, the Pseudo-Mexico fleet, and the entire EPO fleet as a whole. Dolphin vessels do not catch BET and FAD vessels catch smaller proportions of both BET and YFT (see Figure 23 on page 27).

Table 41. Estimated Results of a Pilot Single-Country Buyback Program for the Pseudo-Ecuador Fleet

		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
		$1M Minimum Bid	$2M Minimum Bid	$3M Minimum Bid	Minimum Bid Varies by m^3	Variable Min. & Weight by EPO DAS	Variable Min. & Inverse Weighting
	Remove Enough Capacity to Completely Eliminate Closure Days						
1)	Number of Vessels Removed	19	18	19	20	24	18
2)	Number of Active Vessels Remaining	97	98	97	96	92	98
3)	Capacity Removed (m3)	27,819	30,320	31,826	27,565	29,568	26,992
4)	Capacity Remaining (m3)	68,749	66,248	64,742	69,003	67,000	69,576
5)	Estimated post-buyback closure days	No Closure	No Closure	No Closure	No Closure	No Closure	No Closure
	Increased Revenues After the Buyback Due to Reductions in Closure Days						
6)	Estimated fleet revenue as a percent of SQ	88.1%	85.6%	84.5%	88.7%	87.9%	87.8%
7)	Estimated revenue/vessel as a percent of SQ	105.4%	101.3%	101.1%	107.1%	110.8%	104.0%
8)	Net Operating Revenue Gain per Vessel	$375,007	$380,719	$376,817	$385,188	$406,100	$389,235
	Annual Pilot Program Costs and Fees						
9)	Annual Pilot Program Cost*	$4,834,014	$7,009,823	$9,311,312	$8,375,398	$12,363,811	$8,257,180
10)	Cost ($) per m3 of Capacity Removed	$173.77	$231.19	$292.57	$303.84	$418.15	$305.91
11)	Average Payment per Remaining Vessel	$49,835	$71,529	$95,993	$87,244	$134,389	$84,257
12)	Repayment fee per m3 of remaining capacity	$70.31	$105.81	$143.82	$121.38	$184.53	$118.68
13)	NOR Gains/Vessel less Average Fee	$325,172	$309,190	$280,824	$297,944	$271,711	$304,978
14)	Ratio of NOR Gains to Annual Fee	6.5	4.3	2.9	3.4	2.0	3.6
15)	Fee as a percent of gross revenue	1.3%	2.0%	2.7%	2.3%	3.5%	2.3%

Note: Estimated pilot program cost include only the compensation paid to vessel owners. Other administrative costs are not estimated.

Table 42. Estimated Results of a Pilot Single-Country Buyback Program for the Pseudo-Mexico Fleet

		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
		$1M Minimum Bid	$2M Minimum Bid	$3M Minimum Bid	Minimum Bid Varies by m^3	Variable Min. & Weight by EPO DAS	Variable Min. & Inverse Weighting
	Remove Enough Capacity to Completely Eliminate Closure Days						
1)	Number of Vessels Removed	10	9	8	8	9	8
2)	Number of Active Vessels Remaining	40	41	42	42	41	42
3)	Capacity Removed (m3)	13,590	13,770	12,824	12,479	13,198	11,489
4)	Capacity Remaining (m3)	48,335	48,155	49,101	49,446	48,727	50,436
5)	Estimated post-buyback closure days	No Closure	No Closure	No Closure	No Closure	No Closure	No Closure
	Increased Revenues After the Buyback Due to Reductions in Closure Days						
6)	Estimated fleet revenue as a percent of SQ	99.8%	99.8%	101.5%	98.9%	98.5%	99.6%
7)	Estimated revenue/vessel as a percent of SQ	124.8%	121.8%	120.9%	117.8%	120.1%	118.6%
8)	Net Operating Revenue Gain per Vessel	$127,233	$105,777	$96,295	$93,725	$94,054	$121,807
	Annual Pilot Program Costs and Fees						
9)	Annual Pilot Program Cost*	$1,531,096	$2,544,899	$3,213,091	$3,523,794	$3,878,892	$3,480,848
10)	Cost ($) per m3 of Capacity Removed	$112.66	$184.81	$250.55	$282.38	$293.90	$302.97
11)	Average Payment per Remaining Vessel	$38,277	$62,071	$76,502	$83,900	$94,607	$82,877
12)	Repayment fee per m3 of remaining capacity	$31.68	$52.85	$65.44	$71.27	$79.60	$69.02
13)	NOR Gains/Vessel less Average Fee	$88,956	$43,706	$19,793	$9,825	($553)	$38,930
14)	Ratio of NOR Gains to Annual Fee	2.3	0.7	0.3	0.1	0.0	0.5
15)	Fee as a percent of gross revenue	0.7%	1.2%	1.5%	1.7%	1.9%	1.7%

Note: Estimated pilot program costs include only the compensation paid to vessel owners. Other administrative costs are not estimated.

4.2.4 Annual Vessel Limits on Harvests of Small BET and YFT

This alternative imposes and implements annual vessel-level limits on harvests of **small** BET and YFT. The Small Tuna Vessel Limit (STVL) program builds on ideas discussed during the during the Advisory Committee Meeting in October 2017, indicating that harvests of small BET and YFT currently had greater effects on abundance levels than harvests of larger fish.[33] While the concept was discussed at the Advisory Committee Meeting, this particular program arose from post-meeting discussions within the NEI Team.

The intent of the program is to limit the effective capacity of a small number of operators that catch large quantities of small BET and YFT relative to harvests of most of the fleet, and to incentivize vessels to reduce harvests of small tuna. Initial estimates based on harvest of BET, indicate that a STVL on small BET could lead to sizeable decreases in the harvest of BET, and only directly affect a limited number of vessels. The full assessment will determine whether STVLs for both BET and YFT are feasible.[34]

[33] We are intentionally avoiding the use of terms "juvenile" and "adult" because of the variations in size at sexual maturity. For the purposes of this analysis, small fish are fish less than 15 kg, and correspond to small and medium size categories reported by plant inspectors.

[34] Development of the concept of this program is based on IATTC Document SAC 04-11 "Individual-Vessel Quotas for Purse-Seine Vessels that Fish On Fish-Aggregating Devices (FADs)" published April 2013, and available at www.iattc.org/Meetings/Meetings2013/May/_English/SAC-04-11-Individual-Vessel-Quotas.pdf.

If indeed the program is feasible, and because the program is not an allocation to individual vessels, it is presumed that STVL could potentially be approved and implemented without the controversy and debate that would accompany an IVQ program.

STVL Program details are as follows:

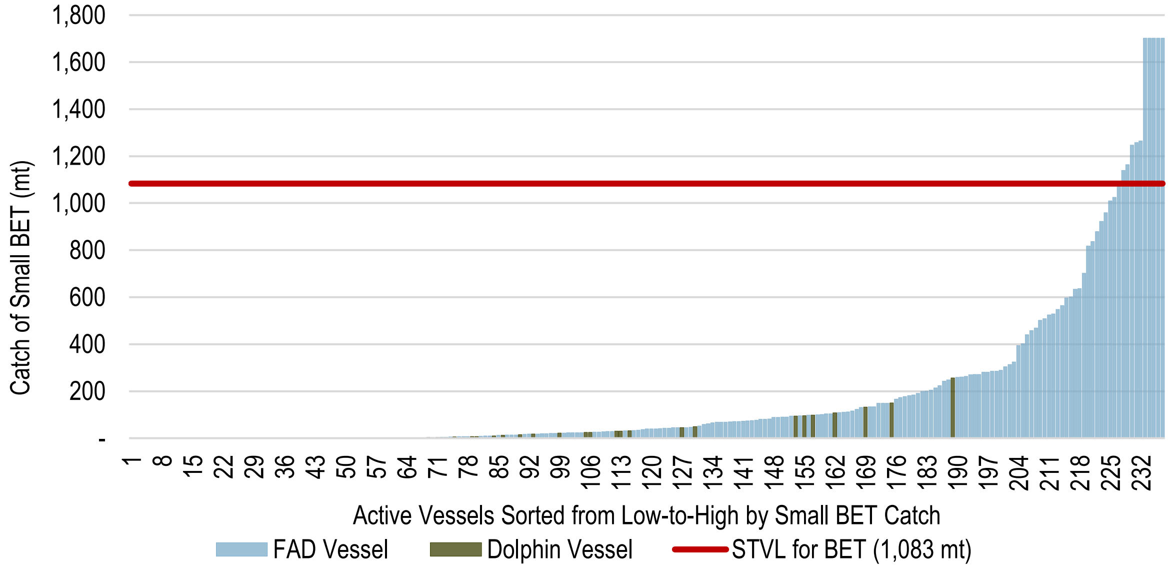
1) Define small BET and YFT as all fish that are less than 15 kg.
2) For purposes of analysis, the BET and YFT STVLs would be set at levels that would eliminate closure days for vessels that remain under the cap, while limiting total catch of BET and YFT to be no greater than harvests under the status quo.
3) Attainment of STVLs at the vessel level would be determined by plant inspector reports.
    a. Accordingly, the number of plant inspectors will need to be increased so that 100 percent of vessel offloads can be observed.
    b. Plant inspector reports of small BET and YFT harvests will be forwarded to IATTC within five days of the completion of the offload.
    c. Enhancements to the observer program and potentially some form of electronic monitoring would be necessary to ensure there are no regulatory discards at sea.
4) For purposes of this analysis attainment if a vessel reaches its STVL of either species, the vessel will not be allowed to fish in the EPO for the remainder of the year.

The distributions of harvests of small BET and small YFT in 2016 were shown in the Figure 37 and Figure 38 on page 39. Those two figures are reproduced below augmented with the respective STVLs for BET and YFT that would be required to completely eliminate closure days for the fleet under the assumption that once a vessel catches its STVL of either BET or YFT it must stop all fishing in the EPO.

The estimated STVL for BET is set at 1,083 mt and the STVL for YFT is set at 982 mt. The STVL as calculated for BET would immediately affect only the top 11 vessels, however the STVL for YFT would immediately affect the harvests of 29 vessels. Assuming the STVLs were set at the beginning of the year, all of these vessels would need to change their fishing behavior or face an even shorter fishing year than they had with the 62-day closure. The STVLs were estimated using an iterative approach first discovers maximum STVL for YFT which would allow the unlimited fleet to fish without closure days and still remain below the STVL and while limiting the total catch of Small YFT to be ≤ 2016 harvests of Small YFT. Once the STVL for YFT is determined the process searches iteratively for the maximum STVL that could be set while allowing the remaining fleet to fish without a closure period, and simultaneously limiting the total catch of Small BET to be ≤ 2016 harvests.

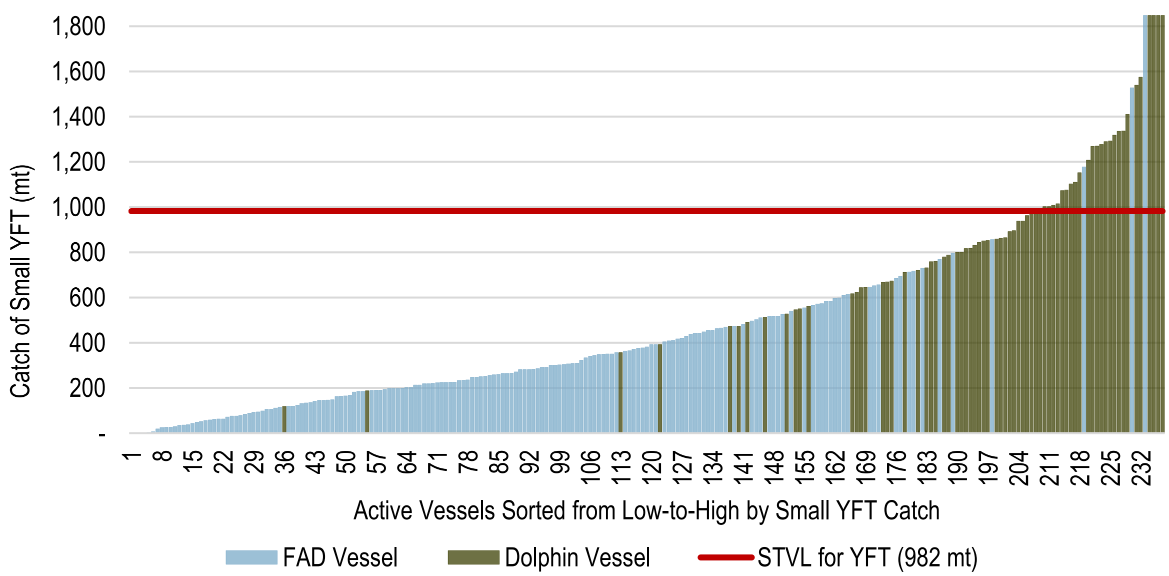
It is important to note that the simulation model used to set the annual limit and to estimate the impacts assumes that vessels are unable to change their behavior to limit harvests of small BET and YFT. In the actual fishery, it is likely that vessels that have a history of catching more than the annual limit of either species will undoubtedly seek to reduce their harvests of small fish. This could potentially be accomplished by altering their fishing gear, changing their set types, or by changing locations if they find they are in areas with high numbers of small tuna.

Figure 54. Estimated Catch of Small BET by Vessel in 2016 Augmented with the Assumed STVL for BET



Source: Developed by Northern Economics using IATTC data.

Figure 55. Estimated Catch of Small YFT by Vessel in 2016 Augmented with the Assumed STVL for YFT



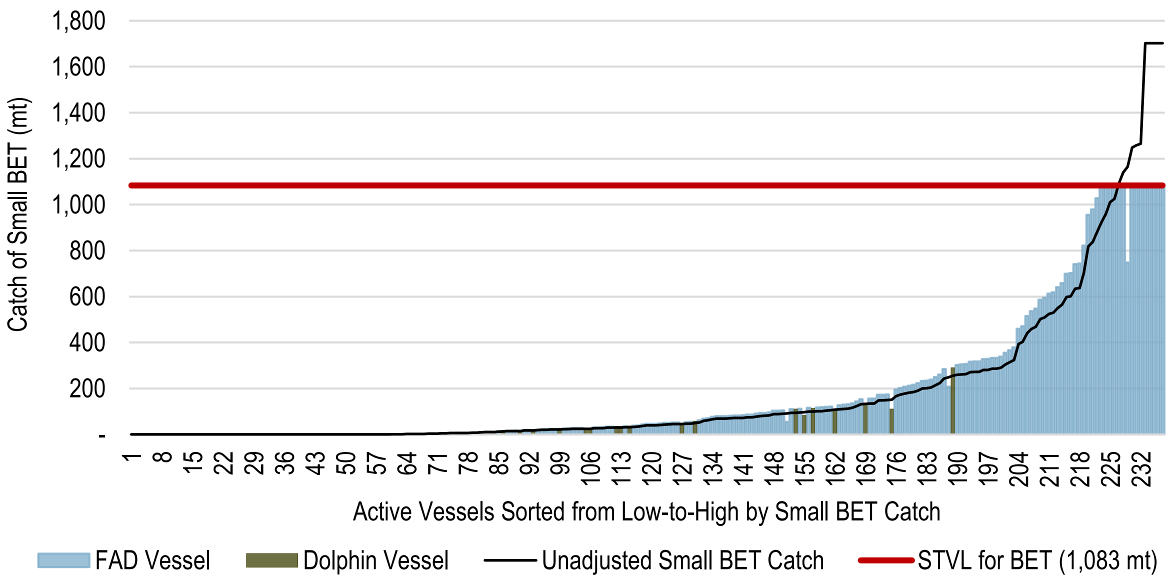
Source: Developed by Northern Economics using IATTC data.

Figure 56 and Figure 57 show simulated results of the 2016 fishery if the STVL for BET and YFT had been in effect. In the figures, the black line traces the original vessel-by-vessel distribution of catch. If the vessel is immediately constrained by either of the STVLs, its catch of small tuna will be below the black line. Thus, for the top 11 BET vessels, their harvests are below their 2016 catches as represented by the black line—

in fact, for one of the top 11 BET vessels, BET harvests are noticeably lower than the STVL for BET. This is because that vessel is also limited by the STVL for YFT. Also note that almost all the vessels that were originally below the STVL have increased their harvests of Small BET. A total of 13 vessels are actually limited by the STVL, noting that this count does not include the 1 vessel among the top 11 that is further constrained by the STVL for YFT. Under the STVLs, 164 vessels will end up catching more BET (both small and large) than they did without the STVLs—these vessels' harvest with the STVL are above the black line.

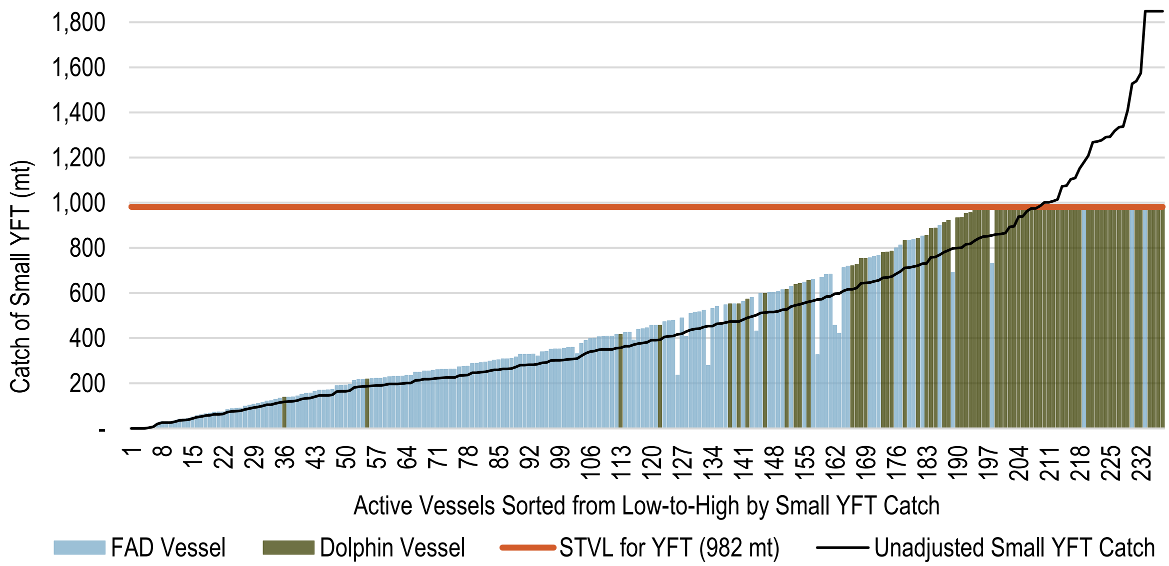
The simulated 2016 harvests for YFT under STVLs (Figure 57) indicate that a total of 42 vessels will end up being limited by the STVL for YFT—3 of which are FAD vessels and 39 of which are Dolphin vessels. Under the STVLs, 195 vessels will end up catching more YFT than they did without the STVLs.

Figure 56. Simulated Effects on Individual Harvests of Small BET in the 2016 Fishing Year under STVLs



Source: Developed by Northern Economics using IATTC data.

Figure 57. Simulated Effects on Individual Harvests of Small YFT in the 2016 Fishing Year under STVLs



Source: Source: Developed by Northern Economics using IATTC data.

After simulating total harvests under the STVLs, the NEI Team estimated the impacts on gross revenues by species and the impacts on NOR as shown in Table 43. For FAD vessels, gross revenues increase over all species combined by $47.4 million, and NOR for all FAD vessels combined increases by $25.5 million. For Dolphin vessels, gross revenues over all species combined decline by $18.7 million, and NOR for all Dolphin vessels moves from -$5.9 million to -$22.2 million, a total decline of $16.3 million.

Setting an STVL on BET appears to benefit the fleet overall while causing negative outcome for relatively few vessels. However, the STVL for YFT, at least as modelled in this assessment, generates negative impacts for many Dolphin vessels which fish primarily for YFT. Unless they are able to change their behaviors, they will see reductions in both small and large YFT harvests.

The primary reason that the STVLs have as large a negative impact on Dolphin vessels is the fact that in general Dolphin vessels catch both small and large YFT in relatively large quantities, with large YFT comprising approximately 64 percent of all YFT in 2014–2016. Therefore, vessels that are limited by the STVL on YFT are also likely to see reductions in their harvests of large YFT. To the extent that Dolphin vessels can actually reduce the percentages of small YFT relative to large YFT, then the negative impacts as analyzed would be mitigated.

Table 43. Changes in Gross Revenue by Species under STVLs, and Estimated NOR

Vessel Type	Revenue Change: YFT	Revenue Change: BET	Revenue Change: SKJ	Revenue Change: PBF & Other	Actual 2016 NOR	NOR for 2016 with STVLs
FAD Vessels	$12,379,941	($30,159)	$32,802,059	$2,302,310	$303,757,967	$329,349,224
Dolphin Vessels	($18,916,796)	$71,445	$188,416	$8,126	($5,856,366)	($22,160,695)
All Vessels	($6,536,854)	$41,286	$32,990,476	$2,310,436	$297,901,601	$307,188,530

4.2.5 An Individual Vessel Quota Program (IVQs)

This program will implement a transferable IVQ program for BET and YFT. A transferable IVQ program is likely to result in market-based reductions in capacity and is therefore a natural fit with other capacity reduction programs. In addition, an IVQ program, if properly structured, could address concerns expressed by the IATTC staff regarding the increasing harvests of smaller BET and YFT. As specified here, the IVQ program will distinguish between small and large tuna based on information provided at the October Advisory Committee meeting indicating that the harvests of small BET and YFT have differential impacts on the population structure of these stocks compared to the harvest of large tuna.[35]

The transferable IVQ program is included in this assessment of capacity reduction alternatives because in theory, capacity in the fishery will be voluntarily removed under the program as more efficient vessels purchase quota from less efficient vessels. The analysis will directly quantify impacts on "active" capacity under a maximum consolidation scenario.

The IVQ assessment will provide initial allocation results for three initial allocation schemes that utilize catch history and registered capacity and a fourth that uses only catch history, but allocates a 10 percent of the QS to NFOs retained in an IATTC pool that could use the shares to facilitate new entrants or other social programs. There are, of course, many ways to determine the initial allocation of IVQs, but the initial allocation options chosen for analysis are based on concepts that have been discussed widely.

Program Details:

1) IATTC would set Annual Catch Limits (ACLs) and make a one-time allocation of IVQs for:
    a. Large[36] BET over all set types (BET over 15 kg)
    b. Large YFT over all set types (YFT over 15 kg)
    c. Small BET over all set types (BET ≤ 15 kg)
    d. Small YFT over all set types (YFT ≤ 15 kg)
    e. An ACL for skipjack will not be set.
2) For purposes of this analysis, it is assumed the program would allocate IVQs based on catch history from the most recent three years (2014–2016) augmented with additional percentage allocations based on the capacity (m^3) of each authorized vessel listed in the IATTC Registry. The distributive impacts of the allocation option will be assessed in some detail.
    a. Under Allocation Option 1, catch history would account for 75 percent of the total allocation, and capacity would account for 25 percent of the total IVQs allocated.
    b. Under Allocation Option 2, catch history would account for 66.7 percent of the total allocation, and capacity would account for 33.3 percent of the total IVQs allocated.
    c. Under Allocation Option 3, catch history would account for 75 percent of the total allocation, and each authorized vessel in the Register would be allocated an equal portion on the remaining 25 percent of the IVQs allocated.
    d. Under Allocation Option 4, catch history would account for 90 percent of the total allocation. The remaining 10 percent of the allocation would be apportioned to the NFOs of each CPC or

[35] The STVL Program described in the previous section has the potential to serve as a precursor to an IVQ program.

[36] We intentionally avoid the use of the terms "juvenile" and "adult" because of the variation in size at sexual maturity. For the purposes of this analysis, small fish are defined as those included in the small- and medium-size categories used by observers (i.e., fish weighing 15 kg. or less).

to other qualified Social Development Organizations (SDOs). The intent of the allocation to NFOs or SDOs is that that shares would be used to facilitate entry into the fishery or benefit other fishery related social programs.

e. For purposes of the quantitative analysis, vessels listed in the current IATTC Vessel Registry as "Inactive" or as "Sunk" will not be issued capacity-based IVQs.

3) The amount of small and large BET and YFT that will be issued to individual vessels will be based on the annual percentage estimates by set type of small and large BET and YFT described under the STVL Program in Section 4.2.4.

4) Each year the IATTC would issue IVQ pounds to holders of IVQ shares for each species in proportion to their shareholdings, such the sum of IVQ pounds for each species/size equals that ACL for that species/size.

5) The default assumption is that IVQs and IVQ Pounds would be fully transferable, but the NEI Team will also qualitatively examine accumulation limits listed below.

   a. Accumulation Limit Options

      i. No limits on accumulation of IVQ shares

      ii. Individual vessels cannot increase their IVQ shares above:

         1. 1.0 percent

         2. 1.5 percent

         3. 2.0 percent

         4. 2.5 percent

         5. 3.0 percent

         6. Vessels that were initially allocated amounts above the limit will be allowed to keep their initial allocation but cannot acquire any additional IVQ shares or IVQ pounds of that species category.

   b. In addition, a brief qualitative assessment of allowing each NFO to regulate transferability and consolidation will be provided.

6) Observer coverage will be enhanced with EM systems to reduce/eliminate discards at sea.

7) Numbers of plant inspectors will be increased so that 100 percent of vessel offloads can be observed. The plant inspector reports will be used to determine attainment of IVQs and splits of small and large fish. It is assumed that plant inspector reports will be forwarded to IATTC in a timely manner, such that the IATTC can determine each vessel's status with respect to its quota prior to the start of the vessel's next trip.

8) Once a vessel uses all its IVQs for a species/size, it must quit fishing and:

   a. return to port, or

   b. acquire additional IVQs through a certified transfer.

4.2.5.1 Assessment of the Initial Allocation of Shares under the IVQ Program

In this assessment of the initial allocation of shares under the IVQ program, the NEI Team first combines size categories of IVQs to examine the initial allocation under the four options on a vessel-by-vessel basis. The vessel-by-vessel examination protects the confidentiality of the vessels and provides valuable insights into mechanics of the allocations—all of which feature dual-allocation protocols. The second part of the assessment of initial allocations separates the allocations by size categories and discusses some of the implications of size-based allocations for the fishery.

Assessment of Initial IVQ Allocation on a Vessel-by-Vessel Basis

The vessel-by-vessel assessment of the initial allocation is built around successive Figures that depict the four different allocation options for each species. Figure 58–Figure 61 on the following two pages summarize the initial allocation for BET, while Figure 62–Figure 65 beginning on page 121 summarize the initial allocations for YFT.

All the figures are organized in the same manner. The vertical bars in the figure represent the allocation to a single vessel as a percentage of the total the allocation of IVQ for the species. Yellow bars represent Latent vessels, green bars represent Dolphin vessels and blue bars represent FAD vessels. In the figures all vessels are sorted first by their catch history of the species from 2014 to 2016. Then, vessels that did not have catch history for that species between 2014 and 2016 are sorted based on their total allocation—since allocations are augmented by the capacity portion of the allocation protocol, vessels that did not have catches between 2014 and 2016 end up being sorted by capacity as well as their allocation. Note that all four figures showing BET allocation are sorted identically—vessel #118 is the same vessel in each of the four BET figures. However, the YFT figures are sorted based YFT catch and allocations—vessel #36 in the BET figures is almost certainly a different vessel than vessel #36 in the YFT figures. In order to protect the confidentiality of individual vessels, the top 10 vessels for both BET and YFT are excluded.

A total of 81 of the 271 vessels on the IATTC register did not catch BET from 2014 to 2016. This includes 25 latent vessels that were on the register, but which did not fish in the EPO from 2014 to 2016, 28 Dolphin vessels that fished but which did catch any BET, and 15 FAD vessels which fished in the EPO, but which did not catch any BET. Similarly, a total of 27 vessels did not land any YFT during the catch history period—25 of these were the latent vessels and the remaining 2 vessels were FAD vessels.

The black lines in all the figures represent the actual catch history of each vessel as a percent of total catch for the species from 2014 to 2016. If catch history from 2014to 2016 was the only factor used in the allocation protocol, then each vessel's allocation (vertical bar) would correspond exactly to the black line. Vessels for which the allocation (vertical bar) exceeds the black line will receive more IVQs than their catch history alone would dictate. Vessels whose allocation falls short of the black line would receive fewer IVQs than their catch history dictates. It is clear that in general, vessels that caught the greatest share of the species will receive fewer IVQs under all four of the allocation Options than if the IVQ allocation was based purely on catch history.

Finally, the light gray line in the figure represents the portion of the allocation that is based on catch history. Under Options 1 and 3, the gray Line is equivalent to 75 percent of the vessel's catch history; Under Options 2 and 4, the gray line represents 67 and 90 percent of the vessel's catch history.

Figure 58. Vessel-by-Vessel Allocation of BET under Option 1: 75% on Catch History | 25% Capacity (m^3)

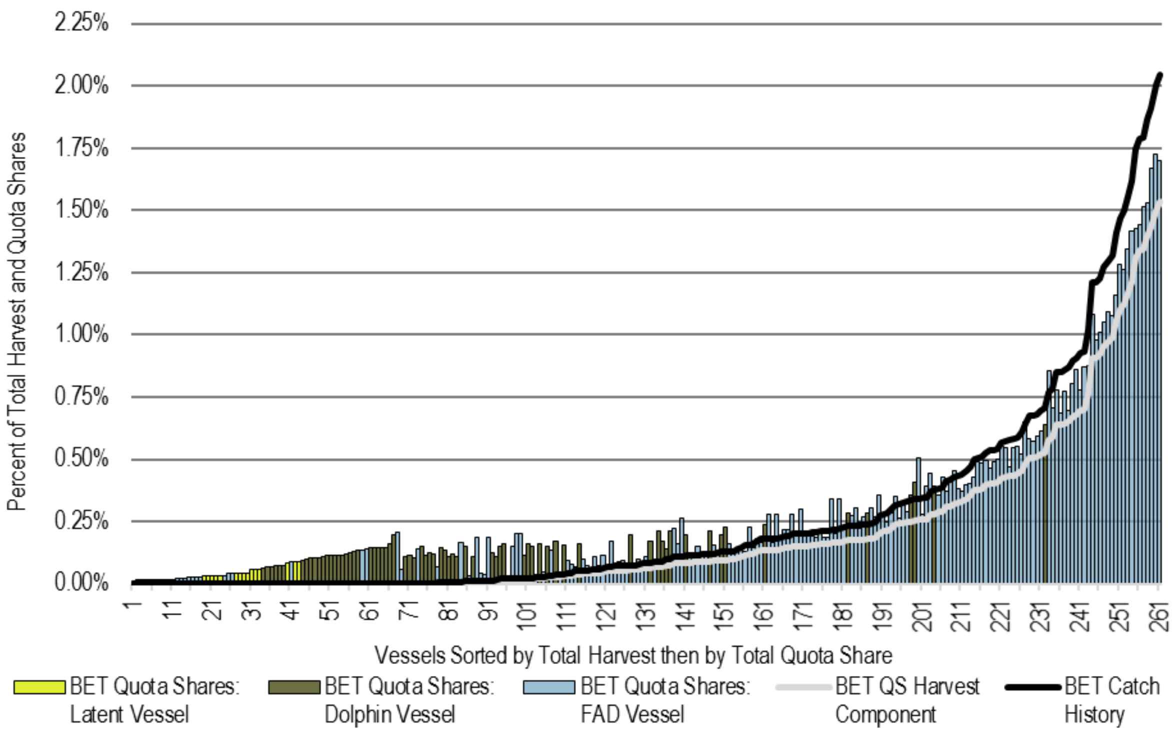


Figure 59. Vessel-by-Vessel Allocation of BET under Option 2: 67% on Catch History | 33% on Capacity (m^3)

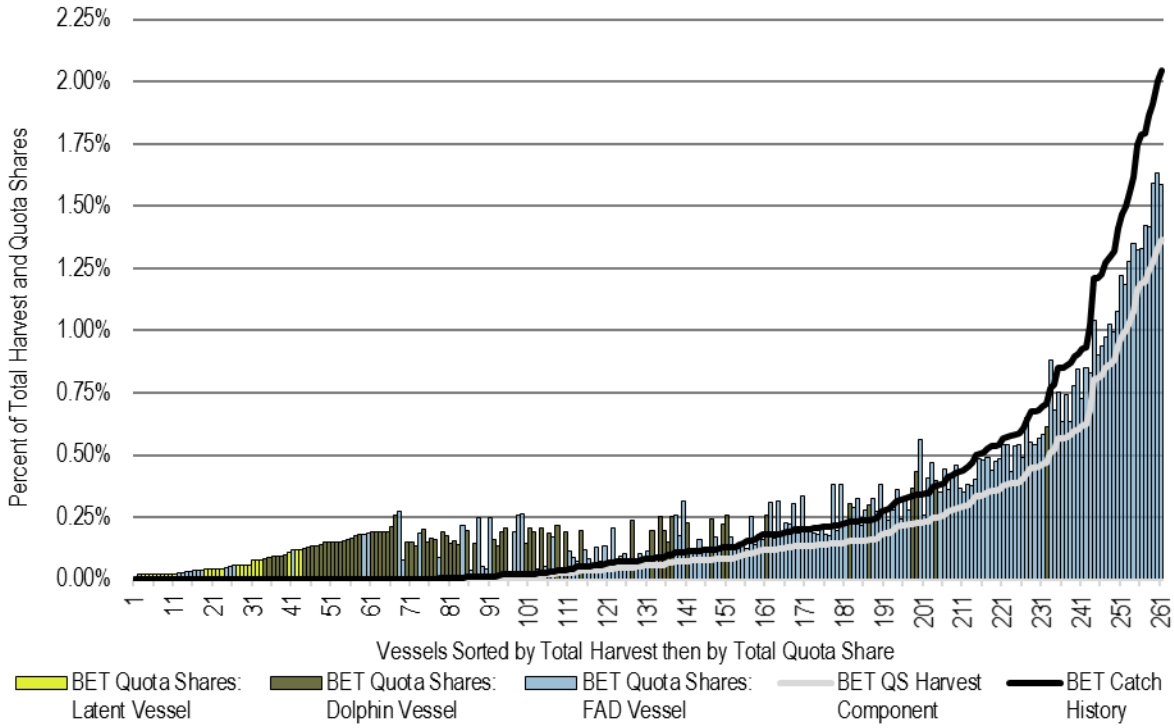


Figure 60. Vessel-by-Vessel Allocation of BET under Option 3: 75% on Catch History | 25% Divided Equally

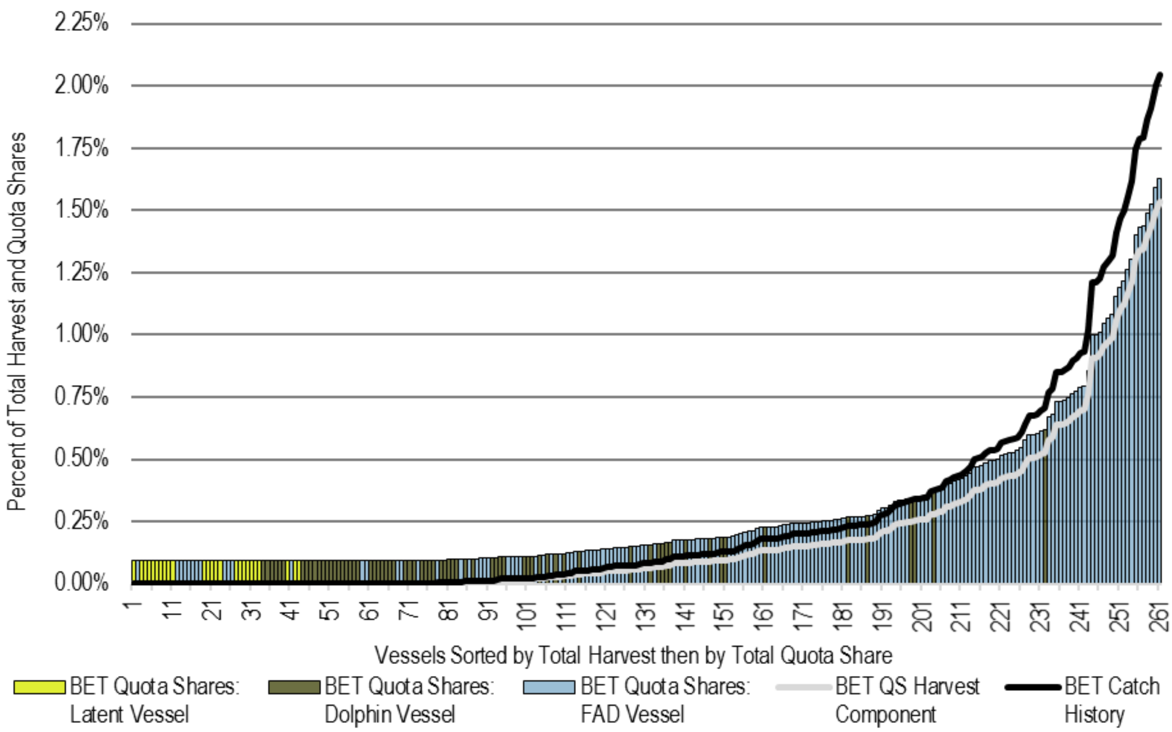


Figure 61. Vessel-by-Vessel Allocation of BET under Option 4: 90% on Catch History | 10% to NFOs/SDOs

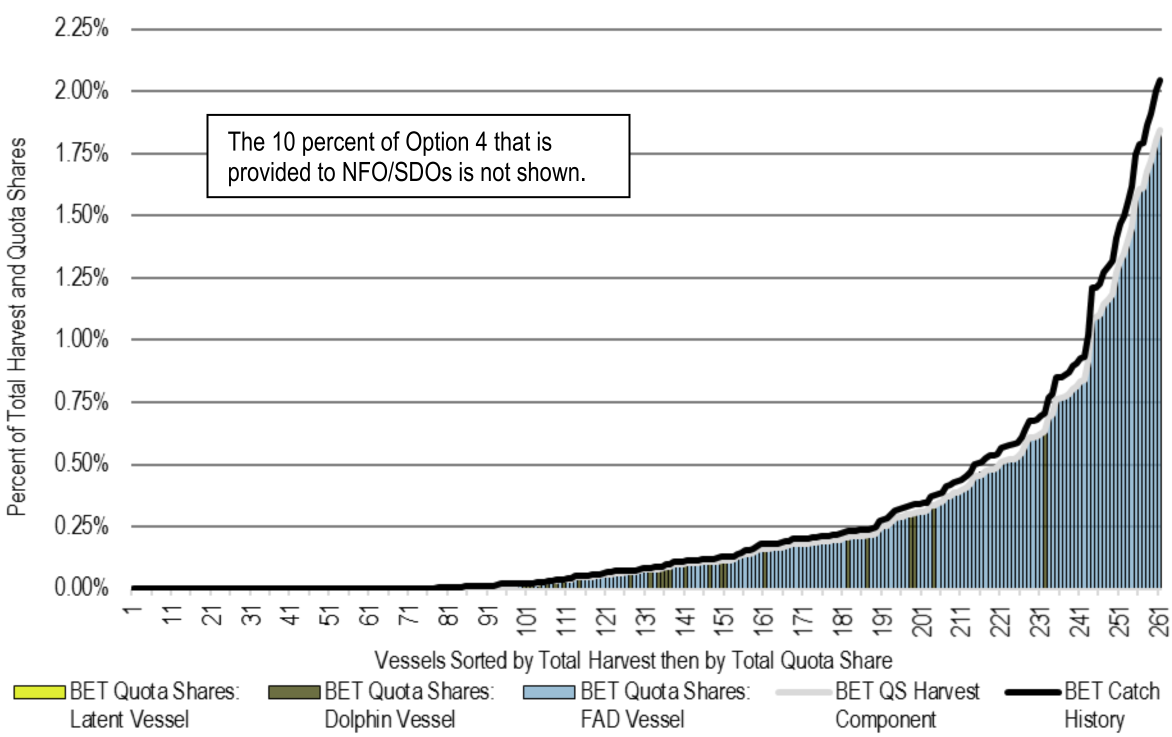


Figure 62. Vessel-by-Vessel Allocation of YFT under Option 1: 75% on Catch History | 25% Capacity (m^3)

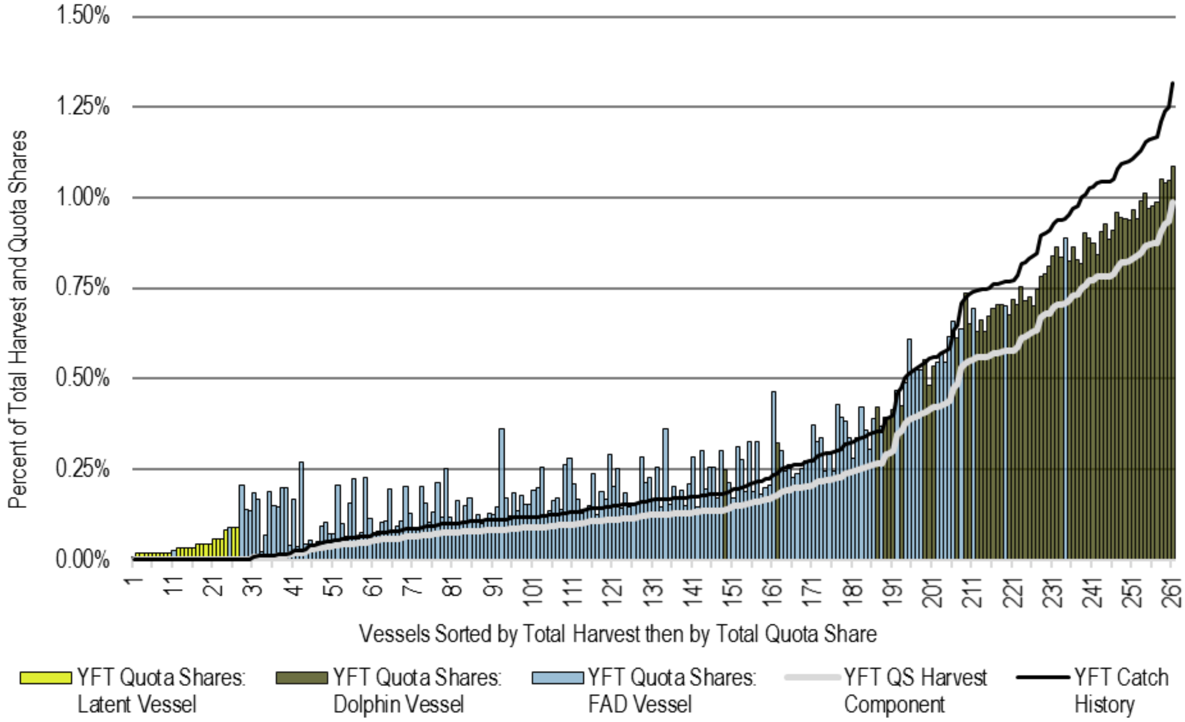


Figure 63. Vessel-by-Vessel Allocation of YFT under Option 2: 67% on Catch History | 33% on Capacity (m^3)

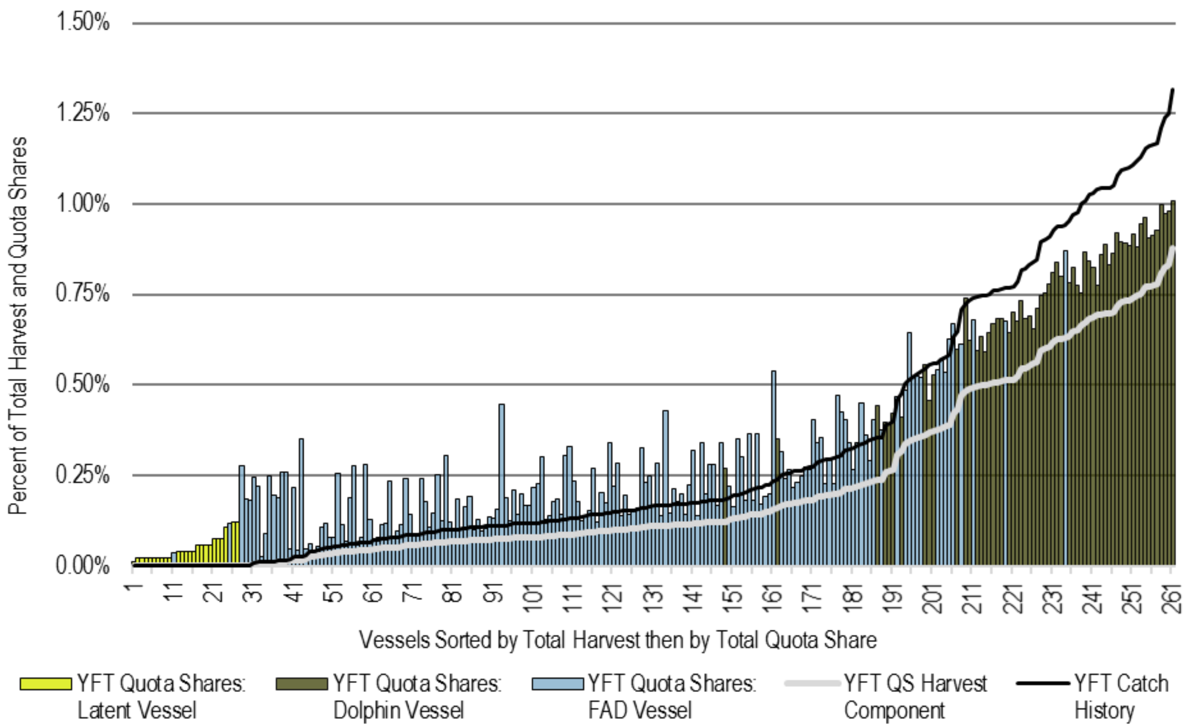


Figure 64. Vessel-by-Vessel Allocation of YFT under Option 3: 75% on Catch History | 25% Divided Equally

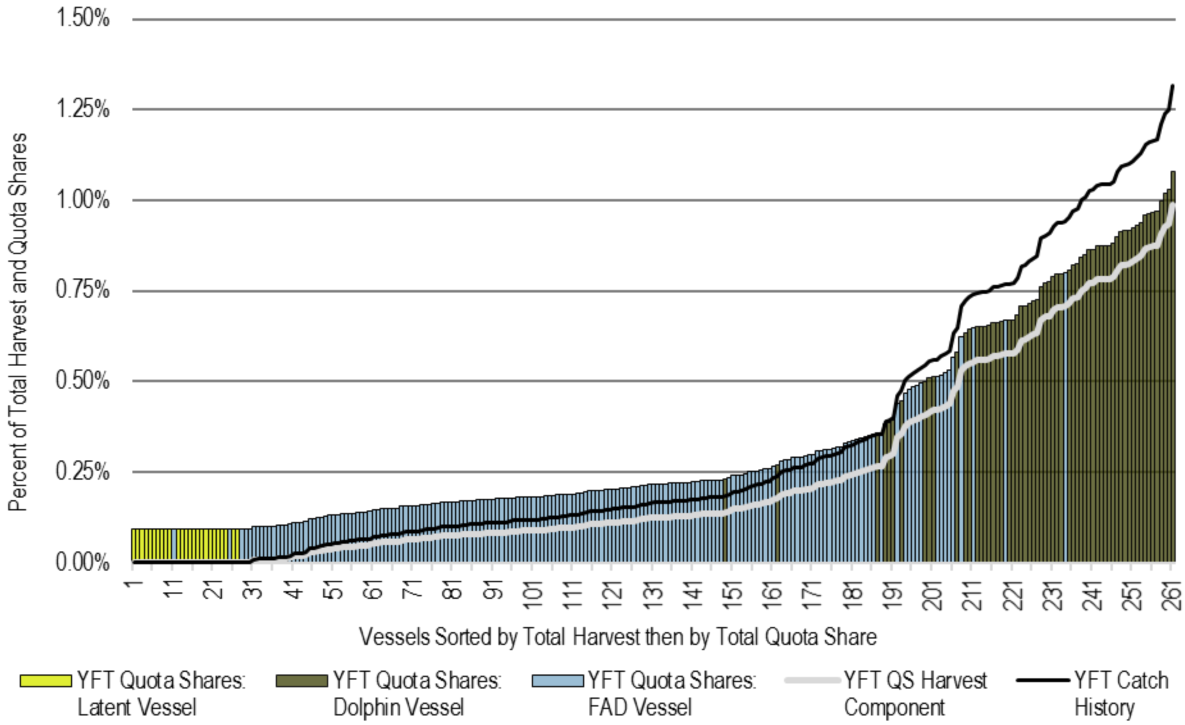
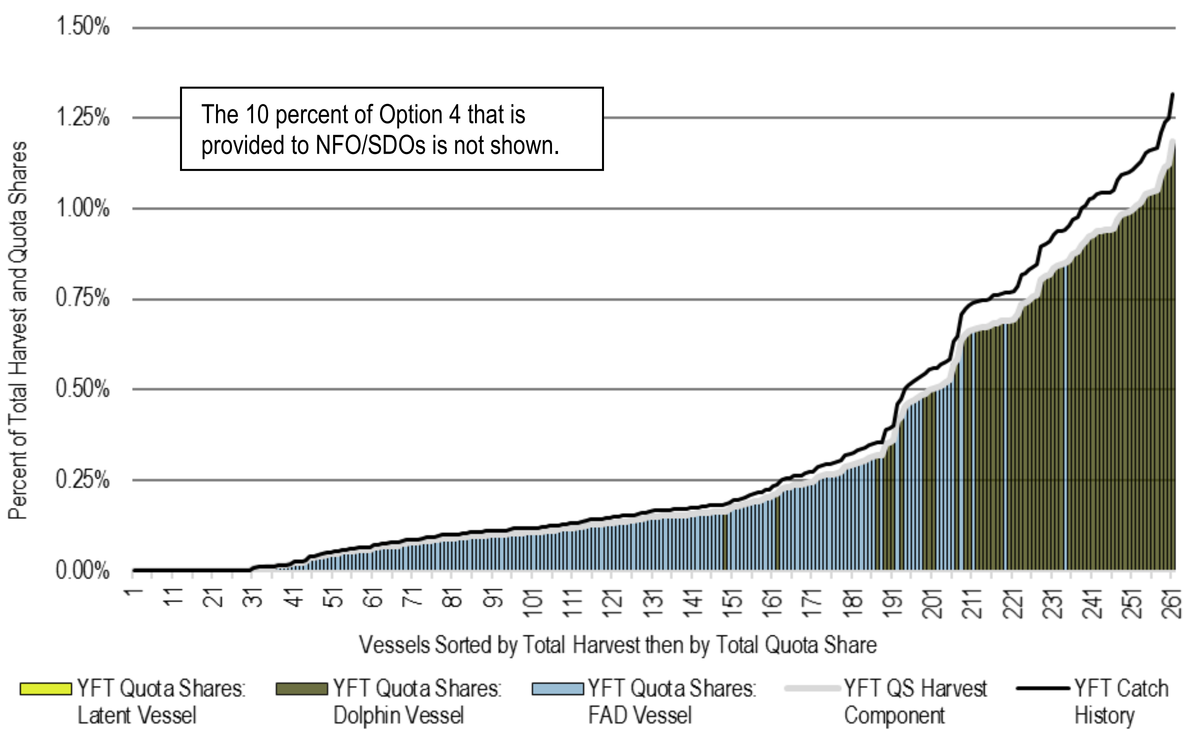


Figure 65. Vessel-by-Vessel Allocation of YFT under Option 4: 90% on Catch History | 10% to NFOs/SDOs



The remainder of the assessment of the initial allocation examines the IVQ allocations by size class. Table 44 shows initial allocations of the four options for both Small and Large BET and Small and Large YFT by vessel type, while

Table 45 shows the allocations by country type. For BET there is very little difference in the proportions of Small and Large BET received by vessel type. Under Option 1 FAD vessels are estimated to receive 87.9 percent of the Small BET and 87.7 percent of the Large BET while Dolphin vessels receive 11.1 percent of the Small BET and 11.3 percent of the Large BET. For YFT however the differences are more noticeable. FAD vessels will receive ≈ 50 percent of the Small YFT and ≈ 32 percent of the Large YFT. Dolphin vessels will get ≈ 48 percent of the Small YFT and ≈ 68 percent of the Large YFT. Similar splits are seen in

Table 45. The differences seen for YFT are a result of the fact that proportions of small and large YFT vary considerably by set type.

Table 44. Initial Allocations of Small and Large IVQs for BET and YFT by Vessel Type

	Small BET	Large BET	All BET	Small YFT	Large YFT	All YFT
Allocation Option		**FAD Vessels**			**FAD Vessels**	
1: 75% Catch | 25% m³	87.9%	87.7%	87.9%	49.8%	31.0%	39.3%
2: 67% Catch | 33% m³	85.2%	85.0%	85.1%	51.3%	34.6%	42.0%
3: 75% Catch | 25% Flat to All	88.4%	88.1%	88.3%	50.2%	31.4%	39.8%
4: 90% Catch | 10% to NFOs/SDOs	86.7%	86.3%	86.6%	40.9%	18.3%	28.3%
Allocation Option		**Dolphin Vessels**			**Dolphin Vessels**	
1: 75% Catch | 25% m³	11.1%	11.3%	11.2%	49.2%	68.0%	59.7%
2: 67% Catch | 33% m³	13.6%	13.8%	13.6%	47.5%	64.2%	56.8%
3: 75% Catch | 25% Flat to All	9.3%	9.6%	9.4%	47.5%	66.3%	57.9%
4: 90% Catch | 10% to NFOs/SDOs	3.3%	3.7%	3.4%	49.1%	71.7%	61.7%
Allocation Option		**Latent Vessels**			**Latent Vessels**	
1: 75% Catch | 25% m³	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%
2: 67% Catch | 33% m³	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%
3: 75% Catch | 25% Flat to All	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%
4: 90% Catch | 10% to NFOs/SDOs	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 45. Initial Allocations of Small and Large IVQs for BET and YFT by Country Type

	Small BET	Large BET	All BET	Small YFT	Large YFT	All YFT
Allocation Option		**2FAD Countries**			**FAD Countries**	
1: 75% Catch | 25% m^3	72.3%	71.9%	72.2%	39.2%	21.8%	29.5%
2: 67% Catch | 33% m^3	70.1%	69.7%	70.0%	40.6%	25.2%	32.0%
3: 75% Catch | 25% Flat to All	73.9%	73.5%	73.8%	40.7%	23.3%	31.0%
4: 90% Catch | 10% to NFOs/SDOs	71.1%	70.5%	70.9%	31.4%	10.5%	19.8%
Allocation Option		**Dolphin Countries**			**Dolphin Countries**	
1: 75% Catch | 25% m^3	9.0%	9.1%	9.0%	42.4%	57.1%	50.6%
2: 67% Catch | 33% m^3	11.5%	11.5%	11.5%	41.2%	54.3%	48.5%
3: 75% Catch | 25% Flat to All	7.9%	8.0%	7.9%	41.4%	56.2%	49.6%
4: 90% Catch | 10% to NFOs/SDOs	1.4%	1.5%	1.4%	41.4%	59.1%	51.2%
Allocation Option		**Mixed Countries**			**Mixed Countries**	
1: 75% Catch | 25% m^3	18.7%	19.0%	18.8%	18.4%	21.1%	19.9%
2: 67% Catch | 33% m^3	18.4%	18.7%	18.5%	18.2%	20.5%	19.5%
3: 75% Catch | 25% Flat to All	18.2%	18.5%	18.3%	17.9%	20.6%	19.4%
4: 90% Catch | 10% to NFOs/SDOs	17.5%	18.1%	17.7%	17.2%	20.4%	19.0%

4.2.5.2 Impacts of Sub-dividing BET and YFT into Small and Large Size Categories

Subdividing BET and YFT into separate ACL and IVQ allocations provides the IATTC with an additional tool for managing harvests of these constraining species. IATTC staff indicate that too many small BET and YFT are being caught relative to large-sized fish to maintain the stocks at sustainable levels. With a split allocation by size, if IATTC scientists conclude that too many Small BET or too many Small YFT continue to be taken, they can reduce the ACL of Small BET and/or Small YFT, relative to the ACLs for Large BET and Large YFT. This will provide incentives for vessel operators to change fishing tactics so that they harvest fewer small fish relative to larger fish. For FAD vessels this may mean they set on fewer FADs and make more unassociated sets, which, based on Figure 33 and Figure 34 in Section 2.1.2.2 have historically had lower catch rates for both small BET and Small YFT than FAD sets. For Dolphin vessels this implies they would need to reduce numbers of NOA sets and OBJ sets.

If vessels are unable to change their operational characteristics to sufficiently avoid Small YFT and Small BET, they can lease or buy Small IVQs from vessels that have been able to reduce their catch of small fish. Alternatively, vessels that are unable to adapt can sell their surplus Large IVQs or exit the fishery entirely and sell all of their IVQs.

4.2.5.3 Assessment of Potential Capacity Reduction under the IVQ Program

The NEI Team has assessed the potential capacity reduction under the IVQ program, while limiting assumptions of behavioral change. The following methodology was used:

1) Calculate the maximum expansion possible for each vessel, assuming maximum increases in trip numbers of average length (with BTSD of average length) but allowing a “last trip” to be shorter than average. The NEI Team assumes this last trip could be as short as the 20th percentile trip and could be preceded by a 20th percentile BTSD;

2) Calculate potential harvests of all species under this maximum, with the exception that PBF harvests are not allowed to expand;[37]
3) Calculate the **Expanded NOR**;
4) Sort vessels by **Expanded NOR**, but interleaving FAD vessels and Dolphin vessels such that the **Expanded Use of BET** and **Expanded Use of YFT** reach BET and YFT total harvest levels under the status quo at the same vessel. In other words, if one more vessel is added into the fleet, then Expanded BET and Expanded YFT are both greater that status quo harvests.

Table 46 summarizes the optimized fleet under the IVQ Program. A total of 195 vessels are projected to remain in the fleet with a total capacity of 211,003 m^3. BET and YFT harvests will remain at or below the status quo levels (2014–2016 average), and Total NOR for the active fleet increases by 169.4 percent to $345 million. In addition, inactive vessels generate an estimated $10.2 from IVQ leases.

Table 46. Summary Statistics of the Optimized Fleet under IVQs

Vessel Type	Count	Capacity (m^3)	BET Harvest (mt)	BET Percent of SQ	YFT Harvest (mt)	YFT Percent of SQ	NOR of Active Vessels	NOR percent of SQ	IVQ Lease Revenue: Inactive Vessels
FAD Vessels	139	136,977	58,818	99.3%	79,062	103.9%	$307,532,517	158.4%	$6,082,710
Dolphin Vessel	56	74,026	2,496	106.5%	162,482	98.2%	$38,448,041	379.6%	$4,113,167
All Vessels	**195**	**211,003**	**61,314**	**99.6%**	**241,544**	**100.0%**	**$345,980,558**	**169.4%**	**$10,195,877**

The NEI Team notes that the "optimized" fleet with 211,000 m^3 as developed in this analysis assumes that individual vessels do not reduce their BTSD to lengths that are less than the vessel's historical average from 2007 to 2016 (noting that estimation of the average BTSD excludes all shore periods that exceed 30 days). For example, if a vessel averaged BTSD of 15 days during the historical period (after dropping BTSD longer than 30 days), the vessel is assumed to continue operating with an average BTSD of 15 days, even though the fleetwide average BTSD is considerably lower. The primary source of additional fishing days under the IVQ optimization derives from the elimination of closure periods and elimination of other BTSD periods that exceed 30 days. Similarly, the optimization developed under the under the IVQ assessment assumes that catch per DAS of each vessel remains the same as that vessels historical average.

Figure 66 shows the use and transfer of combined BET IVQs after optimization as described above. The NEI Team notes that the use and allocation of the top seven vessels have been averaged to ensure confidentiality. A total of 163 vessels are projected to use BET IVQs after the optimization—there are 108 vessels which transfer out all of their allocated BET IVQs including 32 active dolphin vessels that are projected not to use any BET IVQs after optimization. In addition to the vessel owners that transfer out all of their BET IVQs there are another 62 vessels that use a portion of the allocation of BET IVQs but which transfer out surplus IVQs. Of the 271 vessels that receive an initial allocation of BET IVQs, only 101 end up using all of their allocation, all of which also acquire additional BET IVQs during the optimization.

[37] PBF harvests are current limited on an annual basis by the IATTC.

Figure 66. Use and Transfers of Combined BET IVQs after Optimization

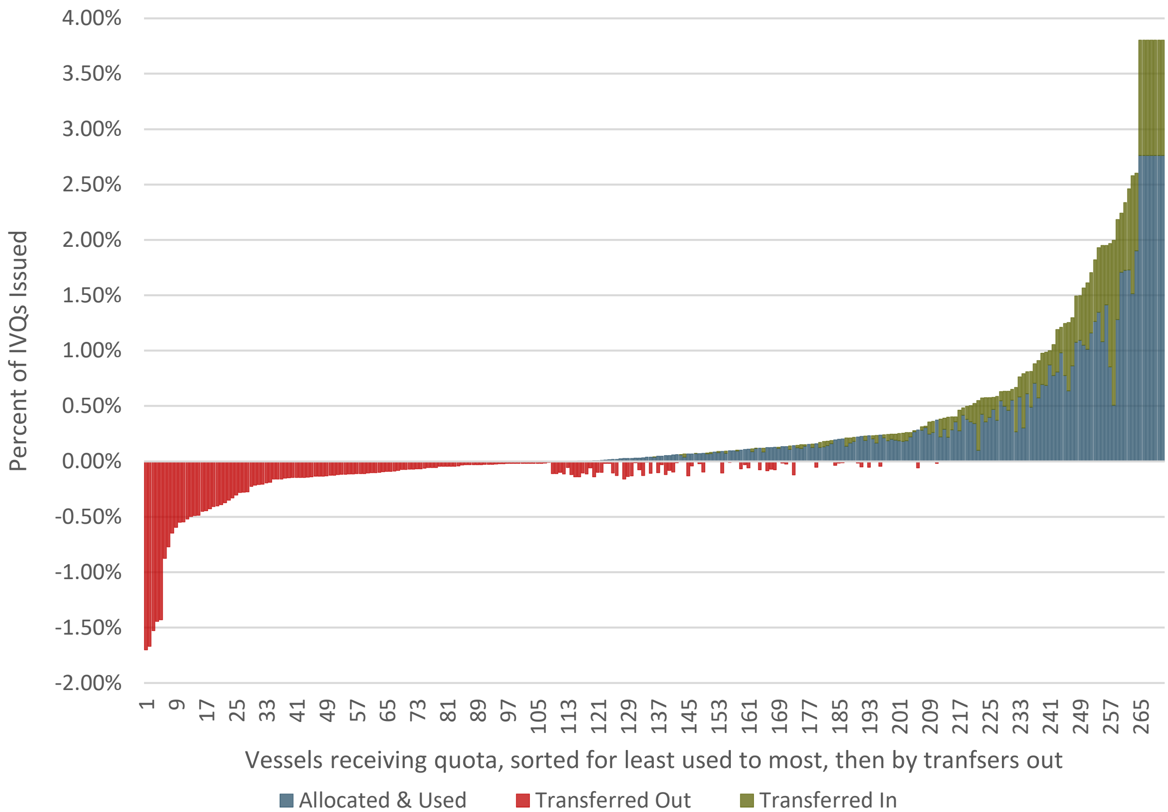
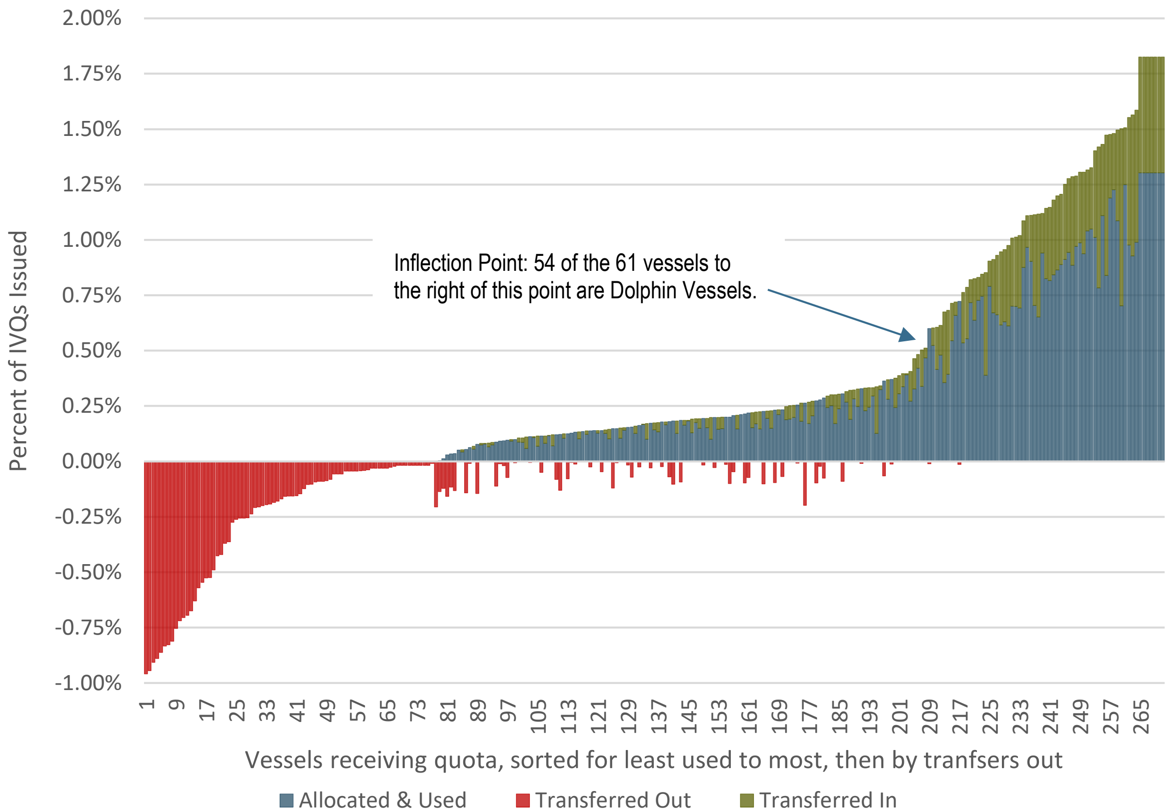


Figure 67 shows the use and transfer of combined YFT IVQs after optimization as described above. As with BET IVQs, the use and allocation of the top seven vessels have been averaged to ensure confidentiality. A total of 194 vessels are projected to use YFT IVQs after the optimization—there are 87 vessels which transfer out all of their allocated YFT IVQs.[38] In addition to the vessel owners that transfer out all of their YFT IVQs, there are another 48 vessels that transfer out surplus IVQs. Of the 271 vessels that receive an initial allocation of YFT IVQs, 136 end up using all of their initial allocation, all of which also acquire additional YFT IVQs during the optimization.

It is also important to note the significant difference in the shapes of the IVQ usage for BET and YFT—the optimized BET IVQ curve is much more concave than the optimized YFT IVQ curve. This is primarily because both FAD vessels and Dolphin vessels catch YFT, while the average Dolphin vessel takes only tiny amounts of BET.

[38] There is one active vessel that is projected to transfer out all of its issued IVQs—this vessel only fishes for PBF.

Figure 67. Use and Transfers of Combined YFT IVQs after Optimization



4.2.5.4 Assessment of Accumulation Limits and Other Restrictions on Transferability

Accumulation limits have been implemented in some of the IVQ programs that have been implemented around the world. Typically, accumulation limits are developed to provide some protection for “smaller” operators, which are often less profitable than larger vessels and which may have less access to capital for purchase of additional IVQs. Accumulation limits are usually designed to keep some level of less than optimal capacity and capital engaged in the fishery.

Typically, accumulation limits in IVQ programs are established with provisions that exempt initial recipients that have received allocations greater than the limit from having to divest IVQs back down to the limit.

In Table 47 the NEI team shows the number of vessels that would exceed a range of accumulation limits under the various initial allocation options. The accumulation limits range from 1.0 percent of the total IVQ or each species/size category up to 2.5 percent. The shapes of the initial allocation curves shown in Figure 58 through Figure 65 provide a clear indication that if accumulation limits are implemented, then the limits set for BET should be different than limits set for YFT.

In Table 47 the number of vessels affected in the initial allocation by the accumulation limits falls if a greater percentage of the IVQs are allocated based on factors other than catch history. Allocating 33 percent of IVQ based on capacity (as in Option 2) means that fewer vessels be allocated IVQs that equal or exceed the cap.

Table 47. Vessels that would Exceed Accumulation Limits under the Initial Allocations

Allocation Option	Accumulation Limit	Small BET	Large BET	Small YFT	Large YFT
		Number of Vessels Allocated QS Greater Than the Accumulation Limit			
75% based on catch history & 25% based on capacity	1.0%	29	28	12	43
	1.5%	20	19	0	12
	2.0%	12	11	0	3
	2.5%	7	7	0	0
67% based on catch history & 33% based on capacity	1.0%	24	24	4	24
	1.5%	13	13	0	3
	2.0%	6	6	0	0
	2.5%	3	3	0	0
75% based on catch history & 25% given as an equal share to all	1.0%	28	26	4	28
	1.5%	13	13	0	3
	2.0%	7	7	0	0
	2.5%	4	4	0	0
90% based on catch history & 10% allocated to NFOs or Pool SDO	1.0%	28	24	7	38
	1.5%	17	11	0	7
	2.0%	8	6	0	0
	2.5%	6	4	0	0

Table 48 summarizes the numbers of vessels under the optimized IVQ fishery that would exceed a range of accumulation limits along with the percentage of combined IVQs for that species these vessels are projected to use. If accumulation limits were set at 1 percent for BET IVQs, a total of 31 vessels would be constrained under the optimized fishery. If these vessels are not limited the NEI Team estimates that they would harvest 69 percent of the BET. If a 1 percent accumulation limits is imposed on YFT IVQs, a total of 41 vessels would be constrained—these vessels are projected to take 57 percent of the total YFT harvest if unconstrained.

Table 48. Accumulation Limits under the Optimized Fishery with IVQs

Combined BET IVQs			Combined YFT IVQs		
Accumulation Limit	Number of Vessels	Percent of IVQs	Accumulation Limit	Number of Vessels	Percent of IVQs
1.00%	31	69%	1.00%	41	57%
1.50%	22	58%	1.25%	27	41%
2.00%	13	41%	1.50%	12	20%
2.50%	9	32%	1.75%	NA	NA

Allow CPCs to Independently Limit Transferability of IVQs

IVQ programs are generally implemented with some form of transferability of shares. Transferability allows managers to implement a "less than optimal" IVQ program in terms of the initial allocation. With transferability, managers have the theoretical assurance that a market for trading shares will evolve and that eventually the program will result in an optimal distribution of shares within whatever limits are imposed. The more that transferability is constrained, the greater the burden to optimize the initial allocation.

It is certainly possible to allow each CPC to independently control transferability of the shares assigned to vessels under their flag. As an example, a CPC may wish to impose a right of first refusal on shares that are being transferred to vessels of another flag state. However, with every limitation on transferability, the fishery will become less likely to realize an economically efficient state.

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Appendix B: Result Tables from the Interactive Buyback Spreadsheet Model

This appendix contains two tables for each of the 48 scenario/capacity reductions combinations within the assessment of the Vessels Buyback Program from Section 4.2.1.

The first of the two tables summarizes the financial aspects of the particular option, while the second provides additional details such as number of vessels by vessel type and country type.

Buyback Results under Scenario 1

Table B-1. Primary Buyback Results: $1 Million Minimum Bid | Reduce Capacity by 20,000 c

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$12,000,000
Total Annual Loan Payment ($)	$1,409,515
Annual Average Loan Payment ($) per Active Vessel	$5,442
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$5.37
Loan Payment Fee as Percent of Future Total Revenue (%)	0.15%
Number of Vessels Bought Out	12
Number of Active Vessels Remaining: 67 Latent Vessels Remain	259
Capacity Removed (m^3)	21,156
Capacity Remaining (m^3)	262,649
Estimated Closure Days After the Buyback	52
Average NOR Gain per Vessel less Average Buyback Loan Payment	$43,786
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$63,227
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$30,868

Table B-2. Detailed Buyback Results: $1 Million Minimum Bid | Reduce Capacity by 20,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	262,649	283,805	-21,156
Total Cost of Buyback	$12,000,000	$0	$12,000,000
Number of Vessels Remaining (Active + Latent)	259	271	-12
Buyback Cost per Vessel Removed	$1,000,000	$0	$1,000,000
Buyback Cost per Remaining Active Vessel	$2,236,079	0	$2,236,079
Average Capacity of Vessels Selling (m^3)	1,763	0	1,763
Estimated Closure Days After the Buyback	52	62	-10
BET Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
YFT Harvested by Remaining Fleet as a % of SQ	100.2%	100.0%	0.2%
SKJ Harvested by Remaining Fleet as a % of SQ	101.0%	100.0%	1.0%
Additional Revenue/Remaining Active Vessels from BET	$10,960	$0	$10,960
Additional Revenue/Remaining Active Vessels from YFT	$48,886	$0	$48,886
Additional Revenue/Remaining Active Vessels from SKJ	$51,599	$0	$51,599
Total Additional Revenue/Remaining Active Vessels	$111,445	$0	$111,445
Estimated Total Fleet Revenue per Year	$911,757,489	$937,723,098	($25,965,609)
Average Revenue/Active Vessel Remaining in the Fleet	$3,520,299	$3,408,854	$111,445
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	103%	100%	3%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,108,318	$1,059,090	$49,228
Net Operating Revenue/Active Vessel as a % of SQ	105%	100%	5%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	14	24	-10
Profitable Vessels in the Remaining Active Fleet	217	219	-2
Vessels Assumed to Sell Out at the Minimum Bid	12	0	12
FAD Vessels in the Remaining Active Fleet	150	157	-7
Dolphin Vessels in the Remaining Active Fleet	81	86	-5

Remaining Active Vessels: FAD Vessel Countries	136	143	-7
Remaining Active Vessels: Dolphin Vessel Countries	63	66	-3
Remaining Active Vessels: Mixed Vessel Countries	32	34	-2

Table B-3. Primary Buyback Results: $1 Million Minimum Bid | Reduce Capacity by 40,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$27,185,974
Total Annual Loan Payment ($)	$3,193,254
Annual Average Loan Payment ($) per Active Vessel	$13,305
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$13.11
Loan Payment Fee as Percent of Future Total Revenue (%)	0.35%
Number of Vessels Bought Out	31
Number of Active Vessels Remaining: 67 Latent Vessels Remain	240
Capacity Removed (m^3)	40,154
Capacity Remaining (m^3)	243,651
Estimated Closure Days After the Buyback	39
Average NOR Gain per Vessel less Average Buyback Loan Payment	$107,463
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$141,529
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$80,607

Table B-4. Detailed Buyback Results: $1 Million Minimum Bid | Reduce Capacity by 40,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	243,651	283,805	-40,154
Total Cost of Buyback	$27,185,974	$0	$27,185,974
Number of Vessels Remaining (Active + Latent)	240	271	-31
Buyback Cost per Vessel Removed	$876,967	$0	$876,967
Buyback Cost per Remaining Active Vessel	$2,074,341	0	$2,074,341
Average Capacity of Vessels Selling (m^3)	1,295	0	1,295
Estimated Closure Days After the Buyback	39	62	-23
BET Harvested by Remaining Fleet as a % of SQ	99.9%	100.0%	-0.1%
YFT Harvested by Remaining Fleet as a % of SQ	96.9%	100.0%	-3.1%
SKJ Harvested by Remaining Fleet as a % of SQ	102.6%	100.0%	2.6%
Additional Revenue/Remaining Active Vessels from BET	$25,951	$0	$25,951
Additional Revenue/Remaining Active Vessels from YFT	$110,220	$0	$110,220
Additional Revenue/Remaining Active Vessels from SKJ	$122,511	$0	$122,511
Total Additional Revenue/Remaining Active Vessels	$258,681	$0	$258,681
Estimated Total Fleet Revenue per Year	$905,184,796	$937,723,098	($32,538,302)
Average Revenue/Active Vessel Remaining in the Fleet	$3,771,603	$3,512,922	$258,681
Note: The value shown for SQ is the unadjusted mean 2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	107%	100%	7%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,179,858	$1,059,090	$120,768
Net Operating Revenue/Active Vessel as a % of SQ	111%	100%	11%
Latent Vessels in the Remaining Fleet	20	28	-8
Unprofitable Vessels in the Remaining Active Fleet	5	24	-19
Profitable Vessels in the Remaining Active Fleet	215	219	-4
Vessels Assumed to Sell Out at the Minimum Bid	30	0	30

FAD Vessels in the Remaining Active Fleet	149	157	-8
Dolphin Vessels in the Remaining Active Fleet	71	86	-15
Remaining Active Vessels: FAD Vessel Countries	134	143	-9
Remaining Active Vessels: Dolphin Vessel Countries	57	66	-9
Remaining Active Vessels: Mixed Vessel Countries	29	34	-5

Table B-5. Primary Buyback Results: $1 Million Minimum Bid | Reduce Capacity by 60,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$50,956,184
Total Annual Loan Payment ($)	$5,985,294
Annual Average Loan Payment ($) per Active Vessel	$28,366
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$26.94
Loan Payment Fee as Percent of Future Total Revenue (%)	0.67%
Number of Vessels Bought Out	60
Number of Active Vessels Remaining: 67 Latent Vessels Remain	211
Capacity Removed (m^3)	61,640
Capacity Remaining (m^3)	222,165
Estimated Closure Days After the Buyback	32
Average NOR Gain per Vessel less Average Buyback Loan Payment	$148,888
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$178,099
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$100,790

Table B-6. Detailed Buyback Results: $1 Million Minimum Bid | Reduce Capacity by 60,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	222,165	283,805	-61,640
Total Cost of Buyback	$50,956,184	$0	$50,956,184
Number of Vessels Remaining (Active + Latent)	211	271	-60
Buyback Cost per Vessel Removed	$849,270	$0	$849,270
Buyback Cost per Remaining Active Vessel	$1,891,416	0	$1,891,416
Average Capacity of Vessels Selling (m^3)	1,027	0	1,027
Estimated Closure Days After the Buyback	32	62	-30
BET Harvested by Remaining Fleet as a % of SQ	99.9%	100.0%	-0.1%
YFT Harvested by Remaining Fleet as a % of SQ	95.4%	100.0%	-4.6%
SKJ Harvested by Remaining Fleet as a % of SQ	102.7%	100.0%	2.7%
Additional Revenue/Remaining Active Vessels from BET	$37,696	$0	$37,696
Additional Revenue/Remaining Active Vessels from YFT	$157,600	$0	$157,600
Additional Revenue/Remaining Active Vessels from SKJ	$178,230	$0	$178,230
Total Additional Revenue/Remaining Active Vessels	$373,526	$0	$373,526
Estimated Total Fleet Revenue per Year	$897,314,964	$937,723,098	($40,408,134)
Average Revenue/Active Vessel Remaining in the Fleet	$4,252,678	$3,879,152	$373,526
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	110%	100%	10%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,236,344	$1,059,090	$177,255
Net Operating Revenue/Active Vessel as a % of SQ	117%	100%	17%
Latent Vessels in the Remaining Fleet	0	28	-28

Unprofitable Vessels in the Remaining Active Fleet	2	24	-22
Profitable Vessels in the Remaining Active Fleet	209	219	-10
Vessels Assumed to Sell Out at the Minimum Bid	54	0	54
FAD Vessels in the Remaining Active Fleet	144	157	-13
Dolphin Vessels in the Remaining Active Fleet	67	86	-19
Remaining Active Vessels: FAD Vessel Countries	129	143	-14
Remaining Active Vessels: Dolphin Vessel Countries	53	66	-13
Remaining Active Vessels: Mixed Vessel Countries	29	34	-5

Table B-7. Primary Buyback Results: $1 Million Minimum Bid | Reduce Capacity by 80,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$85,516,228
Total Annual Loan Payment ($)	$10,044,704
Annual Average Loan Payment ($) per Active Vessel	$50,988
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$49.44
Loan Payment Fee as Percent of Future Total Revenue (%)	1.18%
Number of Vessels Bought Out	74
Number of Active Vessels Remaining: 67 Latent Vessels Remain	197
Capacity Removed (m^3)	80,642
Capacity Remaining (m^3)	203,163
Estimated Closure Days After the Buyback	29
Average NOR Gain per Vessel less Average Buyback Loan Payment	$154,594
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$186,156
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$105,421

Table B-8. Detailed Buyback Results: $1 Million Minimum Bid | Reduce Capacity by 80,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	203,163	283,805	-80,642
Total Cost of Buyback	$85,516,228	$0	$85,516,228
Number of Vessels Remaining (Active + Latent)	197	271	-74
Buyback Cost per Vessel Removed	$1,155,625	$0	$1,155,625
Buyback Cost per Remaining Active Vessel	$1,729,641	0	$1,729,641
Average Capacity of Vessels Selling (m^3)	1,090	0	1,090
Estimated Closure Days After the Buyback	29	62	-33
BET Harvested by Remaining Fleet as a % of SQ	99.8%	100.0%	-0.2%
YFT Harvested by Remaining Fleet as a % of SQ	87.9%	100.0%	-12.1%
SKJ Harvested by Remaining Fleet as a % of SQ	101.0%	100.0%	1.0%
Additional Revenue/Remaining Active Vessels from BET	$43,970	$0	$43,970
Additional Revenue/Remaining Active Vessels from YFT	$168,076	$0	$168,076
Additional Revenue/Remaining Active Vessels from SKJ	$204,589	$0	$204,589
Total Additional Revenue/Remaining Active Vessels	$416,635	$0	$416,635
Estimated Total Fleet Revenue per Year	$854,851,343	$937,723,098	($82,871,755)
Average Revenue/Active Vessel Remaining in the Fleet	$4,339,347	$3,922,712	$416,635
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	111%	100%	11%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,264,672	$1,059,090	$205,582

Net Operating Revenue/Active Vessel as a % of SQ	119%	100%	19%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-1	24	-25
Profitable Vessels in the Remaining Active Fleet	198	219	-21
Vessels Assumed to Sell Out at the Minimum Bid	57	0	57
FAD Vessels in the Remaining Active Fleet	137	157	-20
Dolphin Vessels in the Remaining Active Fleet	60	86	-26
Remaining Active Vessels: FAD Vessel Countries	123	143	-20
Remaining Active Vessels: Dolphin Vessel Countries	46	66	-20
Remaining Active Vessels: Mixed Vessel Countries	28	34	-6

Table B-9. Primary Buyback Results: $1 Million Minimum Bid | Reduce Capacity by 100,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$137,921,970
Total Annual Loan Payment ($)	$16,200,263
Annual Average Loan Payment ($) per Active Vessel	$88,045
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$88.49
Loan Payment Fee as Percent of Future Total Revenue (%)	1.91%
Number of Vessels Bought Out	87
Number of Active Vessels Remaining: 67 Latent Vessels Remain	184
Capacity Removed (m^3)	100,727
Capacity Remaining (m^3)	183,078
Estimated Closure Days After the Buyback	10
Average NOR Gain per Vessel less Average Buyback Loan Payment	$251,219
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$294,913
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$186,059

Table B-10. Detailed Buyback Results: $1 Million Minimum Bid | Reduce Capacity by 100,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	183,078	283,805	-100,727
Total Cost of Buyback	$137,921,970	$0	$137,921,970
Number of Vessels Remaining (Active + Latent)	184	271	-87
Buyback Cost per Vessel Removed	$1,585,310	$0	$1,585,310
Buyback Cost per Remaining Active Vessel	$1,558,646	0	$1,558,646
Average Capacity of Vessels Selling (m^3)	1,158	0	1,158
Estimated Closure Days After the Buyback	10	62	-52
BET Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
YFT Harvested by Remaining Fleet as a % of SQ	85.3%	100.0%	-14.7%
SKJ Harvested by Remaining Fleet as a % of SQ	101.8%	100.0%	1.8%
Additional Revenue/Remaining Active Vessels from BET	$70,189	$0	$70,189
Additional Revenue/Remaining Active Vessels from YFT	$260,900	$0	$260,900
Additional Revenue/Remaining Active Vessels from SKJ	$328,143	$0	$328,143
Total Additional Revenue/Remaining Active Vessels	$659,233	$0	$659,233
Estimated Total Fleet Revenue per Year	$847,825,669	$937,723,098	($89,897,428)
Average Revenue/Active Vessel Remaining in the Fleet	$4,607,748	$3,948,516	$659,233

Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.

Revenue/Remaining Active Vessel as a Percent of SQ	117%	100%	17%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,398,353	$1,059,090	$339,263
Net Operating Revenue/Active Vessel as a % of SQ	132%	100%	32%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-1	24	-25
Profitable Vessels in the Remaining Active Fleet	185	219	-34
Vessels Assumed to Sell Out at the Minimum Bid	57	0	57
FAD Vessels in the Remaining Active Fleet	131	157	-26
Dolphin Vessels in the Remaining Active Fleet	53	86	-33
Remaining Active Vessels: FAD Vessel Countries	118	143	-25
Remaining Active Vessels: Dolphin Vessel Countries	40	66	-26
Remaining Active Vessels: Mixed Vessel Countries	26	34	-8

Table B-11. Primary Buyback Results: $1 Million Minimum Bid | Reduce Capacity to 171,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$180,318,546
Total Annual Loan Payment ($)	$21,180,149
Annual Average Loan Payment ($) per Active Vessel	$121,029
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$124.20
Loan Payment Fee as Percent of Future Total Revenue (%)	2.54%
Number of Vessels Bought Out	96
Number of Active Vessels Remaining: 67 Latent Vessels Remain	175
Capacity Removed (m^3)	113,269
Capacity Remaining (m^3)	170,536
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$290,661
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$344,129
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$210,683

Table B-12. Detailed Buyback Results: $1 Million Minimum Bid | Reduce Capacity to 171,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	170,536	283,805	-113,269
Total Cost of Buyback	$180,318,546	$0	$180,318,546
Number of Vessels Remaining (Active + Latent)	175	271	-96
Buyback Cost per Vessel Removed	$1,878,318	$0	$1,878,318
Buyback Cost per Remaining Active Vessel	$1,451,869	0	$1,451,869
Average Capacity of Vessels Selling (m^3)	1,180	0	1,180
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	98.5%	100.0%	-1.5%
YFT Harvested by Remaining Fleet as a % of SQ	83.0%	100.0%	-17.0%
SKJ Harvested by Remaining Fleet as a % of SQ	100.6%	100.0%	0.6%
Additional Revenue/Remaining Active Vessels from BET	$82,927	$0	$82,927
Additional Revenue/Remaining Active Vessels from YFT	$311,331	$0	$311,331
Additional Revenue/Remaining Active Vessels from SKJ	$394,096	$0	$394,096
Total Additional Revenue/Remaining Active Vessels	$788,353	$0	$788,353
Estimated Total Fleet Revenue per Year	$832,432,970	$937,723,098	($105,290,128)
Average Revenue/Active Vessel Remaining in the Fleet	$4,756,760	$3,968,406	$788,353

Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,470,780	$1,059,090	$411,691
Net Operating Revenue/Active Vessel as a % of SQ	139%	100%	39%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-2	24	-26
Profitable Vessels in the Remaining Active Fleet	177	219	-42
Vessels Assumed to Sell Out at the Minimum Bid	58	0	58
FAD Vessels in the Remaining Active Fleet	126	157	-31
Dolphin Vessels in the Remaining Active Fleet	49	86	-37
Remaining Active Vessels: FAD Vessel Countries	114	143	-29
Remaining Active Vessels: Dolphin Vessel Countries	36	66	-30
Remaining Active Vessels: Mixed Vessel Countries	25	34	-9

Table B-13. Primary Buyback Results: $1 Million Minimum Bid | Reduce Capacity to 158,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$240,144,064
Total Annual Loan Payment ($)	$28,207,232
Annual Average Loan Payment ($) per Active Vessel	$171,995
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$178.91
Loan Payment Fee as Percent of Future Total Revenue (%)	3.58%
Number of Vessels Bought Out	107
Number of Active Vessels Remaining: 67 Latent Vessels Remain	164
Capacity Removed (m^3)	126,146
Capacity Remaining (m^3)	157,659
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$252,769
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$304,665
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$169,771

Table B-14. Detailed Buyback Results: $1 Million Minimum Bid | Reduce Capacity to 158,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	157,659	283,805	-126,146
Total Cost of Buyback	$240,144,064	$0	$240,144,064
Number of Vessels Remaining (Active + Latent)	164	271	-107
Buyback Cost per Vessel Removed	$2,244,337	$0	$2,244,337
Buyback Cost per Remaining Active Vessel	$1,342,240	0	$1,342,240
Average Capacity of Vessels Selling (m^3)	1,179	0	1,179
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	94.9%	100.0%	-5.1%
YFT Harvested by Remaining Fleet as a % of SQ	75.4%	100.0%	-24.6%
SKJ Harvested by Remaining Fleet as a % of SQ	97.6%	100.0%	-2.4%
Additional Revenue/Remaining Active Vessels from BET	$86,894	$0	$86,894
Additional Revenue/Remaining Active Vessels from YFT	$298,525	$0	$298,525
Additional Revenue/Remaining Active Vessels from SKJ	$410,046	$0	$410,046
Total Additional Revenue/Remaining Active Vessels	$795,465	$0	$795,465

Estimated Total Fleet Revenue per Year	$787,685,640	$937,723,098	($150,037,458)
Average Revenue/Active Vessel Remaining in the Fleet	$4,802,961	$4,007,496	$795,465
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,483,854	$1,059,090	$424,764
Net Operating Revenue/Active Vessel as a % of SQ	140%	100%	40%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-2	24	-26
Profitable Vessels in the Remaining Active Fleet	166	219	-53
Vessels Assumed to Sell Out at the Minimum Bid	58	0	58
FAD Vessels in the Remaining Active Fleet	121	157	-36
Dolphin Vessels in the Remaining Active Fleet	43	86	-43
Remaining Active Vessels: FAD Vessel Countries	111	143	-32
Remaining Active Vessels: Dolphin Vessel Countries	31	66	-35
Remaining Active Vessels: Mixed Vessel Countries	22	34	-12

Table B-15. Primary Buyback Results: $1 Million Minimum Bid | Reduce Capacity to Eliminate Closure

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$148,216,392
Total Annual Loan Payment ($)	$17,409,442
Annual Average Loan Payment ($) per Active Vessel	$96,185
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$96.87
Loan Payment Fee as Percent of Future Total Revenue (%)	2.02%
Number of Vessels Bought Out	90
Number of Active Vessels Remaining: 67 Latent Vessels Remain	181
Capacity Removed (m^3)	104,083
Capacity Remaining (m^3)	179,722
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$307,325
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$366,173
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$232,425

Table B-16. Detailed Buyback Results: $1 Million Minimum Bid | Reduce Capacity to Eliminate Closure

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	179,722	283,805	-104,083
Total Cost of Buyback	$148,216,392	$0	$148,216,392
Number of Vessels Remaining (Active + Latent)	181	271	-90
Buyback Cost per Vessel Removed	$1,646,849	$0	$1,646,849
Buyback Cost per Remaining Active Vessel	$1,530,075	0	$1,530,075
Average Capacity of Vessels Selling (m^3)	1,156	0	1,156
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	101.6%	100.0%	1.6%
YFT Harvested by Remaining Fleet as a % of SQ	86.8%	100.0%	-13.2%
SKJ Harvested by Remaining Fleet as a % of SQ	103.4%	100.0%	3.4%
Additional Revenue/Remaining Active Vessels from BET	$82,879	$0	$82,879
Additional Revenue/Remaining Active Vessels from YFT	$314,108	$0	$314,108

Additional Revenue/Remaining Active Vessels from SKJ	$388,536	$0	$388,536
Total Additional Revenue/Remaining Active Vessels	$785,524	$0	$785,524
Estimated Total Fleet Revenue per Year	$861,583,824	$937,723,098	($76,139,274)
Average Revenue/Active Vessel Remaining in the Fleet	$4,760,132	$3,974,608	$785,524
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,462,599	$1,059,090	$403,509
Net Operating Revenue/Active Vessel as a % of SQ	138%	100%	38%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-2	24	-26
Profitable Vessels in the Remaining Active Fleet	183	219	-36
Vessels Assumed to Sell Out at the Minimum Bid	58	0	58
FAD Vessels in the Remaining Active Fleet	129	157	-28
Dolphin Vessels in the Remaining Active Fleet	52	86	-34
Remaining Active Vessels: FAD Vessel Countries	116	143	-27
Remaining Active Vessels: Dolphin Vessel Countries	39	66	-27
Remaining Active Vessels: Mixed Vessel Countries	26	34	-8

Buyback Results under Scenario 2

Table B-17. Primary Buyback Results: $2 Million Minimum Bid | Reduce Capacity by 20,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$22,229,709
Total Annual Loan Payment ($)	$2,611,093
Annual Average Loan Payment ($) per Active Vessel	$10,043
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$9.90
Loan Payment Fee as Percent of Future Total Revenue (%)	0.29%
Number of Vessels Bought Out	11
Number of Active Vessels Remaining: 67 Latent Vessels Remain	260
Capacity Removed (m^3)	20,056
Capacity Remaining (m^3)	263,749
Estimated Closure Days After the Buyback	53
Average NOR Gain per Vessel less Average Buyback Loan Payment	$33,339
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$48,753
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$25,520

Table B-18. Detailed Buyback Results: $2 Million Minimum Bid | Reduce Capacity by 20,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	263,749	283,805	-20,056
Total Cost of Buyback	$22,229,709	$0	$22,229,709
Number of Vessels Remaining (Active + Latent)	260	271	-11
Buyback Cost per Vessel Removed	$2,020,883	$0	$2,020,883
Buyback Cost per Remaining Active Vessel	$2,245,444	0	$2,245,444
Average Capacity of Vessels Selling (m^3)	1,823	0	1,823
Estimated Closure Days After the Buyback	53	62	-9
BET Harvested by Remaining Fleet as a % of SQ	99.8%	100.0%	-0.2%

YFT Harvested by Remaining Fleet as a % of SQ	97.8%	100.0%	-2.2%
SKJ Harvested by Remaining Fleet as a % of SQ	101.1%	100.0%	1.1%
Additional Revenue/Remaining Active Vessels from BET	$9,776	$0	$9,776
Additional Revenue/Remaining Active Vessels from YFT	$41,937	$0	$41,937
Additional Revenue/Remaining Active Vessels from SKJ	$45,418	$0	$45,418
Total Additional Revenue/Remaining Active Vessels	$97,131	$0	$97,131
Estimated Total Fleet Revenue per Year	$902,839,254	$937,723,098	($34,883,844)
Average Revenue/Active Vessel Remaining in the Fleet	$3,472,459	$3,375,328	$97,131
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	103%	100%	3%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,102,471	$1,059,090	$43,381
Net Operating Revenue/Active Vessel as a % of SQ	104%	100%	4%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	15	24	-9
Profitable Vessels in the Remaining Active Fleet	217	219	-2
Vessels Assumed to Sell Out at the Minimum Bid	10	0	10
FAD Vessels in the Remaining Active Fleet	153	157	-4
Dolphin Vessels in the Remaining Active Fleet	79	86	-7
Remaining Active Vessels: FAD Vessel Countries	139	143	-4
Remaining Active Vessels: Dolphin Vessel Countries	61	66	-5
Remaining Active Vessels: Mixed Vessel Countries	32	34	-2

Table B-19. Primary Buyback Results: $2 Million Minimum Bid | Reduce Capacity by 40,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$49,690,538
Total Annual Loan Payment ($)	$5,836,632
Annual Average Loan Payment ($) per Active Vessel	$23,630
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$23.97
Loan Payment Fee as Percent of Future Total Revenue (%)	0.64%
Number of Vessels Bought Out	24
Number of Active Vessels Remaining: 67 Latent Vessels Remain	247
Capacity Removed (m^3)	40,283
Capacity Remaining (m^3)	243,522
Estimated Closure Days After the Buyback	36
Average NOR Gain per Vessel less Average Buyback Loan Payment	$106,597
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$156,671
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$69,733

Table B-20. Detailed Buyback Results: $2 Million Minimum Bid | Reduce Capacity by 40,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	243,522	283,805	-40,283
Total Cost of Buyback	$49,690,538	$0	$49,690,538
Number of Vessels Remaining (Active + Latent)	247	271	-24
Buyback Cost per Vessel Removed	$2,070,439	$0	$2,070,439
Buyback Cost per Remaining Active Vessel	$2,073,240	0	$2,073,240
Average Capacity of Vessels Selling (m^3)	1,678	0	1,678

Estimated Closure Days After the Buyback	36	62	-26
BET Harvested by Remaining Fleet as a % of SQ	100.6%	100.0%	0.6%
YFT Harvested by Remaining Fleet as a % of SQ	98.8%	100.0%	-1.2%
SKJ Harvested by Remaining Fleet as a % of SQ	102.7%	100.0%	2.7%
Additional Revenue/Remaining Active Vessels from BET	$28,244	$0	$28,244
Additional Revenue/Remaining Active Vessels from YFT	$122,111	$0	$122,111
Additional Revenue/Remaining Active Vessels from SKJ	$133,289	$0	$133,289
Total Additional Revenue/Remaining Active Vessels	$283,644	$0	$283,644
Estimated Total Fleet Revenue per Year	$914,000,121	$937,723,098	($23,722,976)
Average Revenue/Active Vessel Remaining in the Fleet	$3,700,405	$3,416,761	$283,644
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	108%	100%	8%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,189,316	$1,059,090	$130,227
Net Operating Revenue/Active Vessel as a % of SQ	112%	100%	12%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	8	24	-16
Profitable Vessels in the Remaining Active Fleet	211	219	-8
Vessels Assumed to Sell Out at the Minimum Bid	20	0	20
FAD Vessels in the Remaining Active Fleet	146	157	-11
Dolphin Vessels in the Remaining Active Fleet	73	86	-13
Remaining Active Vessels: FAD Vessel Countries	131	143	-12
Remaining Active Vessels: Dolphin Vessel Countries	58	66	-8
Remaining Active Vessels: Mixed Vessel Countries	30	34	-4

Table B-21. Primary Buyback Results: $2 Million Minimum Bid | Reduce Capacity by 60,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$86,130,478
Total Annual Loan Payment ($)	$10,116,854
Annual Average Loan Payment ($) per Active Vessel	$44,568
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$45.28
Loan Payment Fee as Percent of Future Total Revenue (%)	1.17%
Number of Vessels Bought Out	44
Number of Active Vessels Remaining: 67 Latent Vessels Remain	227
Capacity Removed (m^3)	60,399
Capacity Remaining (m^3)	223,406
Estimated Closure Days After the Buyback	35
Average NOR Gain per Vessel less Average Buyback Loan Payment	$103,923
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$147,665
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$122,463

Table B-22. Detailed Buyback Results: $2 Million Minimum Bid | Reduce Capacity by 60,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	223,406	283,805	-60,399
Total Cost of Buyback	$86,130,478	$0	$86,130,478
Number of Vessels Remaining (Active + Latent)	227	271	-44
Buyback Cost per Vessel Removed	$1,957,511	$0	$1,957,511

Buyback Cost per Remaining Active Vessel	$1,901,984	0	$1,901,984
Average Capacity of Vessels Selling (m^3)	1,373	0	1,373
Estimated Closure Days After the Buyback	35	62	-27
BET Harvested by Remaining Fleet as a % of SQ	99.8%	100.0%	-0.2%
YFT Harvested by Remaining Fleet as a % of SQ	90.0%	100.0%	-10.0%
SKJ Harvested by Remaining Fleet as a % of SQ	101.1%	100.0%	1.1%
Additional Revenue/Remaining Active Vessels from BET	$31,764	$0	$31,764
Additional Revenue/Remaining Active Vessels from YFT	$125,383	$0	$125,383
Additional Revenue/Remaining Active Vessels from SKJ	$148,000	$0	$148,000
Total Additional Revenue/Remaining Active Vessels	$305,147	$0	$305,147
Estimated Total Fleet Revenue per Year	$863,884,890	$937,723,098	($73,838,208)
Average Revenue/Active Vessel Remaining in the Fleet	$3,805,660	$3,500,513	$305,147
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	109%	100%	9%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,207,580	$1,059,090	$148,491
Net Operating Revenue/Active Vessel as a % of SQ	114%	100%	14%
Latent Vessels in the Remaining Fleet	20	28	-8
Unprofitable Vessels in the Remaining Active Fleet	5	24	-19
Profitable Vessels in the Remaining Active Fleet	202	219	-17
Vessels Assumed to Sell Out at the Minimum Bid	33	0	33
FAD Vessels in the Remaining Active Fleet	144	157	-13
Dolphin Vessels in the Remaining Active Fleet	63	86	-23
Remaining Active Vessels: FAD Vessel Countries	130	143	-13
Remaining Active Vessels: Dolphin Vessel Countries	49	66	-17
Remaining Active Vessels: Mixed Vessel Countries	28	34	-6

Table B-23. Primary Buyback Results: $2 Million Minimum Bid | Reduce Capacity by 80,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$126,910,418
Total Annual Loan Payment ($)	$14,906,850
Annual Average Loan Payment ($) per Active Vessel	$74,534
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$73.16
Loan Payment Fee as Percent of Future Total Revenue (%)	1.76%
Number of Vessels Bought Out	71
Number of Active Vessels Remaining: 67 Latent Vessels Remain	200
Capacity Removed (m^3)	80,048
Capacity Remaining (m^3)	203,757
Estimated Closure Days After the Buyback	31
Average NOR Gain per Vessel less Average Buyback Loan Payment	$116,093
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$140,805
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$98,471

Table B-24. Detailed Buyback Results: $2 Million Minimum Bid | Reduce Capacity by 80,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	203,757	283,805	-80,048
Total Cost of Buyback	$126,910,418	$0	$126,910,418

Number of Vessels Remaining (Active + Latent)	200	271	-71
Buyback Cost per Vessel Removed	$1,787,471	$0	$1,787,471
Buyback Cost per Remaining Active Vessel	$1,734,698	0	$1,734,698
Average Capacity of Vessels Selling (m^3)	1,127	0	1,127
Estimated Closure Days After the Buyback	31	62	-31
BET Harvested by Remaining Fleet as a % of SQ	99.9%	100.0%	-0.1%
YFT Harvested by Remaining Fleet as a % of SQ	86.2%	100.0%	-13.8%
SKJ Harvested by Remaining Fleet as a % of SQ	101.1%	100.0%	1.1%
Additional Revenue/Remaining Active Vessels from BET	$40,962	$0	$40,962
Additional Revenue/Remaining Active Vessels from YFT	$153,916	$0	$153,916
Additional Revenue/Remaining Active Vessels from SKJ	$190,464	$0	$190,464
Total Additional Revenue/Remaining Active Vessels	$385,342	$0	$385,342
Estimated Total Fleet Revenue per Year	$849,360,138	$937,723,098	($88,362,960)
Average Revenue/Active Vessel Remaining in the Fleet	$4,246,801	$3,861,459	$385,342
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	110%	100%	10%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,249,717	$1,059,090	$190,627
Net Operating Revenue/Active Vessel as a % of SQ	118%	100%	18%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	4	24	-20
Profitable Vessels in the Remaining Active Fleet	196	219	-23
Vessels Assumed to Sell Out at the Minimum Bid	55	0	55
FAD Vessels in the Remaining Active Fleet	141	157	-16
Dolphin Vessels in the Remaining Active Fleet	59	86	-27
Remaining Active Vessels: FAD Vessel Countries	127	143	-16
Remaining Active Vessels: Dolphin Vessel Countries	45	66	-21
Remaining Active Vessels: Mixed Vessel Countries	28	34	-6

Table B-25. Primary Buyback Results: $2 Million Minimum Bid | Reduce Capacity by 100,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$184,030,149
Total Annual Loan Payment ($)	$21,616,112
Annual Average Loan Payment ($) per Active Vessel	$116,844
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$118.35
Loan Payment Fee as Percent of Future Total Revenue (%)	2.57%
Number of Vessels Bought Out	86
Number of Active Vessels Remaining: 67 Latent Vessels Remain	185
Capacity Removed (m^3)	101,167
Capacity Remaining (m^3)	182,638
Estimated Closure Days After the Buyback	12
Average NOR Gain per Vessel less Average Buyback Loan Payment	$209,592
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$244,584
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$159,983

Table B-26. Detailed Buyback Results: $2 Million Minimum Bid | Reduce Capacity by 100,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m³)	182,638	283,805	-101,167
Total Cost of Buyback	$184,030,149	$0	$184,030,149
Number of Vessels Remaining (Active + Latent)	185	271	-86
Buyback Cost per Vessel Removed	$2,139,885	$0	$2,139,885
Buyback Cost per Remaining Active Vessel	$1,554,900	0	$1,554,900
Average Capacity of Vessels Selling (m³)	1,176	0	1,176
Estimated Closure Days After the Buyback	12	62	-50
BET Harvested by Remaining Fleet as a % of SQ	99.8%	100.0%	-0.2%
YFT Harvested by Remaining Fleet as a % of SQ	84.4%	100.0%	-15.6%
SKJ Harvested by Remaining Fleet as a % of SQ	101.2%	100.0%	1.2%
Additional Revenue/Remaining Active Vessels from BET	$67,502	$0	$67,502
Additional Revenue/Remaining Active Vessels from YFT	$249,827	$0	$249,827
Additional Revenue/Remaining Active Vessels from SKJ	$314,218	$0	$314,218
Total Additional Revenue/Remaining Active Vessels	$631,547	$0	$631,547
Estimated Total Fleet Revenue per Year	$841,828,162	$937,723,098	($95,894,936)
Average Revenue/Active Vessel Remaining in the Fleet	$4,550,422	$3,918,876	$631,547
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	116%	100%	16%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,385,525	$1,059,090	$326,436
Net Operating Revenue/Active Vessel as a % of SQ	131%	100%	31%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	1	24	-23
Profitable Vessels in the Remaining Active Fleet	184	219	-35
Vessels Assumed to Sell Out at the Minimum Bid	60	0	60
FAD Vessels in the Remaining Active Fleet	133	157	-24
Dolphin Vessels in the Remaining Active Fleet	52	86	-34
Remaining Active Vessels: FAD Vessel Countries	120	143	-23
Remaining Active Vessels: Dolphin Vessel Countries	39	66	-27
Remaining Active Vessels: Mixed Vessel Countries	26	34	-8

Table B-27. Primary Buyback Results: $2 Million Minimum Bid | Reduce Capacity to 171,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$228,437,722
Total Annual Loan Payment ($)	$26,832,209
Annual Average Loan Payment ($) per Active Vessel	$152,456
Annual Average Loan Payment ($) per m³ of Remaining Fleet	$157.96
Loan Payment Fee as Percent of Future Total Revenue (%)	3.24%
Number of Vessels Bought Out	95
Number of Active Vessels Remaining: 67 Latent Vessels Remain	176
Capacity Removed (m³)	113,943
Capacity Remaining (m³)	169,862
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$258,518

Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$314,541
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$202,184

Table B-28. Detailed Buyback Results: $2 Million Minimum Bid | Reduce Capacity to 171,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	169,862	283,805	-113,943
Total Cost of Buyback	$228,437,722	$0	$228,437,722
Number of Vessels Remaining (Active + Latent)	176	271	-95
Buyback Cost per Vessel Removed	$2,404,608	$0	$2,404,608
Buyback Cost per Remaining Active Vessel	$1,446,131	0	$1,446,131
Average Capacity of Vessels Selling (m^3)	1,199	0	1,199
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	96.6%	100.0%	-3.4%
YFT Harvested by Remaining Fleet as a % of SQ	82.9%	100.0%	-17.1%
SKJ Harvested by Remaining Fleet as a % of SQ	99.9%	100.0%	-0.1%
Additional Revenue/Remaining Active Vessels from BET	$81,899	$0	$81,899
Additional Revenue/Remaining Active Vessels from YFT	$309,728	$0	$309,728
Additional Revenue/Remaining Active Vessels from SKJ	$389,899	$0	$389,899
Total Additional Revenue/Remaining Active Vessels	$781,526	$0	$781,526
Estimated Total Fleet Revenue per Year	$828,075,775	$937,723,098	($109,647,323)
Average Revenue/Active Vessel Remaining in the Fleet	$4,704,976	$3,923,450	$781,526
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,470,063	$1,059,090	$410,973
Net Operating Revenue/Active Vessel as a % of SQ	139%	100%	39%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-1	24	-25
Profitable Vessels in the Remaining Active Fleet	177	219	-42
Vessels Assumed to Sell Out at the Minimum Bid	62	0	62
FAD Vessels in the Remaining Active Fleet	127	157	-30
Dolphin Vessels in the Remaining Active Fleet	49	86	-37
Remaining Active Vessels: FAD Vessel Countries	115	143	-28
Remaining Active Vessels: Dolphin Vessel Countries	37	66	-29
Remaining Active Vessels: Mixed Vessel Countries	24	34	-10

Table B-29. Primary Buyback Results: $2 Million Minimum Bid | Reduce Capacity to 158,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$285,046,324
Total Annual Loan Payment ($)	$33,481,434
Annual Average Loan Payment ($) per Active Vessel	$202,918
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$211.96
Loan Payment Fee as Percent of Future Total Revenue (%)	4.25%
Number of Vessels Bought Out	106
Number of Active Vessels Remaining: 67 Latent Vessels Remain	165
Capacity Removed (m^3)	125,841
Capacity Remaining (m^3)	157,964

Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$219,283
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$269,835
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$169,639

Table B-30. Detailed Buyback Results: $2 Million Minimum Bid | Reduce Capacity to 158,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m³)	157,964	283,805	-125,841
Total Cost of Buyback	$285,046,324	$0	$285,046,324
Number of Vessels Remaining (Active + Latent)	165	271	-106
Buyback Cost per Vessel Removed	$2,689,116	$0	$2,689,116
Buyback Cost per Remaining Active Vessel	$1,344,837	0	$1,344,837
Average Capacity of Vessels Selling (m³)	1,187	0	1,187
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	94.9%	100.0%	-5.1%
YFT Harvested by Remaining Fleet as a % of SQ	75.4%	100.0%	-24.6%
SKJ Harvested by Remaining Fleet as a % of SQ	97.6%	100.0%	-2.4%
Additional Revenue/Remaining Active Vessels from BET	$86,368	$0	$86,368
Additional Revenue/Remaining Active Vessels from YFT	$296,715	$0	$296,715
Additional Revenue/Remaining Active Vessels from SKJ	$407,573	$0	$407,573
Total Additional Revenue/Remaining Active Vessels	$790,656	$0	$790,656
Estimated Total Fleet Revenue per Year	$787,697,273	$937,723,098	($150,025,825)
Average Revenue/Active Vessel Remaining in the Fleet	$4,773,923	$3,983,266	$790,656
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,481,291	$1,059,090	$422,201
Net Operating Revenue/Active Vessel as a % of SQ	140%	100%	40%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-1	24	-25
Profitable Vessels in the Remaining Active Fleet	166	219	-53
Vessels Assumed to Sell Out at the Minimum Bid	63	0	63
FAD Vessels in the Remaining Active Fleet	122	157	-35
Dolphin Vessels in the Remaining Active Fleet	43	86	-43
Remaining Active Vessels: FAD Vessel Countries	112	143	-31
Remaining Active Vessels: Dolphin Vessel Countries	31	66	-35
Remaining Active Vessels: Mixed Vessel Countries	22	34	-12

Table B-31. Primary Buyback Results: $2 Million Minimum Bid | Reduce Capacity to Eliminate Closure

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$215,804,147
Total Annual Loan Payment ($)	$25,348,274
Annual Average Loan Payment ($) per Active Vessel	$141,610
Annual Average Loan Payment ($) per m³ of Remaining Fleet	$146.36
Loan Payment Fee as Percent of Future Total Revenue (%)	3.01%
Number of Vessels Bought Out	92
Number of Active Vessels Remaining: 67 Latent Vessels Remain	179

Capacity Removed (m3)	110,618
Capacity Remaining (m3)	173,187
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$266,623
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$313,463
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$208,691

Table B-32. Detailed Buyback Results: $2 Million Minimum Bid | Reduce Capacity to Eliminate Closure

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m3)	173,187	283,805	-110,618
Total Cost of Buyback	$215,804,147	$0	$215,804,147
Number of Vessels Remaining (Active + Latent)	179	271	-92
Buyback Cost per Vessel Removed	$2,345,697	$0	$2,345,697
Buyback Cost per Remaining Active Vessel	$1,474,439	0	$1,474,439
Average Capacity of Vessels Selling (m3)	1,202	0	1,202
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	100.4%	100.0%	0.4%
YFT Harvested by Remaining Fleet as a % of SQ	83.9%	100.0%	-16.1%
SKJ Harvested by Remaining Fleet as a % of SQ	101.6%	100.0%	1.6%
Additional Revenue/Remaining Active Vessels from BET	$83,807	$0	$83,807
Additional Revenue/Remaining Active Vessels from YFT	$308,037	$0	$308,037
Additional Revenue/Remaining Active Vessels from SKJ	$391,000	$0	$391,000
Total Additional Revenue/Remaining Active Vessels	$782,843	$0	$782,843
Estimated Total Fleet Revenue per Year	$842,183,054	$937,723,098	($95,540,044)
Average Revenue/Active Vessel Remaining in the Fleet	$4,704,933	$3,922,090	$782,843
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,467,323	$1,059,090	$408,233
Net Operating Revenue/Active Vessel as a % of SQ	139%	100%	39%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	0	24	-24
Profitable Vessels in the Remaining Active Fleet	179	219	-40
Vessels Assumed to Sell Out at the Minimum Bid	61	0	61
FAD Vessels in the Remaining Active Fleet	129	157	-28
Dolphin Vessels in the Remaining Active Fleet	50	86	-36
Remaining Active Vessels: FAD Vessel Countries	116	143	-27
Remaining Active Vessels: Dolphin Vessel Countries	37	66	-29
Remaining Active Vessels: Mixed Vessel Countries	26	34	-8

Buyback Results under Scenario 3

Table B-33. Primary Buyback Results: $3 Million Minimum Bid | Reduce Capacity by 20,000 m3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$33,765,871
Total Annual Loan Payment ($)	$3,966,127
Annual Average Loan Payment ($) per Active Vessel	$15,254

Annual Average Loan Payment ($) per m³ of Remaining Fleet	$15.10
Loan Payment Fee as Percent of Future Total Revenue (%)	0.44%
Number of Vessels Bought Out	11
Number of Active Vessels Remaining: 67 Latent Vessels Remain	260
Capacity Removed (m³)	21,097
Capacity Remaining (m³)	262,708
Estimated Closure Days After the Buyback	53
Average NOR Gain per Vessel less Average Buyback Loan Payment	$27,997
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$44,463
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$17,415

Table B-34. Detailed Buyback Results: $3 Million Minimum Bid | Reduce Capacity by 20,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m³)	262,708	283,805	-21,097
Total Cost of Buyback	$33,765,871	$0	$33,765,871
Number of Vessels Remaining (Active + Latent)	260	271	-11
Buyback Cost per Vessel Removed	$3,069,625	$0	$3,069,625
Buyback Cost per Remaining Active Vessel	$2,236,581	0	$2,236,581
Average Capacity of Vessels Selling (m³)	1,918	0	1,918
Estimated Closure Days After the Buyback	53	62	-9
BET Harvested by Remaining Fleet as a % of SQ	99.9%	100.0%	-0.1%
YFT Harvested by Remaining Fleet as a % of SQ	98.6%	100.0%	-1.4%
SKJ Harvested by Remaining Fleet as a % of SQ	101.0%	100.0%	1.0%
Additional Revenue/Remaining Active Vessels from BET	$9,793	$0	$9,793
Additional Revenue/Remaining Active Vessels from YFT	$42,224	$0	$42,224
Additional Revenue/Remaining Active Vessels from SKJ	$45,528	$0	$45,528
Total Additional Revenue/Remaining Active Vessels	$97,546	$0	$97,546
Estimated Total Fleet Revenue per Year	$905,779,820	$937,723,098	($31,943,278)
Average Revenue/Active Vessel Remaining in the Fleet	$3,483,769	$3,386,223	$97,546
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	103%	100%	3%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,102,341	$1,059,090	$43,251
Net Operating Revenue/Active Vessel as a % of SQ	104%	100%	4%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	18	24	-6
Profitable Vessels in the Remaining Active Fleet	214	219	-5
Vessels Assumed to Sell Out at the Minimum Bid	9	0	9
FAD Vessels in the Remaining Active Fleet	151	157	-6
Dolphin Vessels in the Remaining Active Fleet	81	86	-5
Remaining Active Vessels: FAD Vessel Countries	137	143	-6
Remaining Active Vessels: Dolphin Vessel Countries	62	66	-4
Remaining Active Vessels: Mixed Vessel Countries	33	34	-1

Table B-35. Primary Buyback Results: $3 Million Minimum Bid | Reduce Capacity by 40,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$72,765,871

Total Annual Loan Payment ($)	$8,547,052
Annual Average Loan Payment ($) per Active Vessel	$34,603
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$35.24
Loan Payment Fee as Percent of Future Total Revenue (%)	0.95%
Number of Vessels Bought Out	24
Number of Active Vessels Remaining: 67 Latent Vessels Remain	247
Capacity Removed (m^3)	41,295
Capacity Remaining (m^3)	242,510
Estimated Closure Days After the Buyback	41
Average NOR Gain per Vessel less Average Buyback Loan Payment	$69,750
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$110,160
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$41,522

Table B-36. Detailed Buyback Results: $3 Million Minimum Bid | Reduce Capacity by 40,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	242,510	283,805	-41,295
Total Cost of Buyback	$72,765,871	$0	$72,765,871
Number of Vessels Remaining (Active + Latent)	247	271	-24
Buyback Cost per Vessel Removed	$3,031,911	$0	$3,031,911
Buyback Cost per Remaining Active Vessel	$2,064,624	0	$2,064,624
Average Capacity of Vessels Selling (m^3)	1,721	0	1,721
Estimated Closure Days After the Buyback	41	62	-21
BET Harvested by Remaining Fleet as a % of SQ	99.9%	100.0%	-0.1%
YFT Harvested by Remaining Fleet as a % of SQ	97.0%	100.0%	-3.0%
SKJ Harvested by Remaining Fleet as a % of SQ	101.3%	100.0%	1.3%
Additional Revenue/Remaining Active Vessels from BET	$23,162	$0	$23,162
Additional Revenue/Remaining Active Vessels from YFT	$97,515	$0	$97,515
Additional Revenue/Remaining Active Vessels from SKJ	$107,889	$0	$107,889
Total Additional Revenue/Remaining Active Vessels	$228,567	$0	$228,567
Estimated Total Fleet Revenue per Year	$900,296,173	$937,723,098	($37,426,925)
Average Revenue/Active Vessel Remaining in the Fleet	$3,644,924	$3,416,357	$228,567
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	107%	100%	7%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,163,443	$1,059,090	$104,354
Net Operating Revenue/Active Vessel as a % of SQ	110%	100%	10%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	11	24	-13
Profitable Vessels in the Remaining Active Fleet	208	219	-11
Vessels Assumed to Sell Out at the Minimum Bid	22	0	22
FAD Vessels in the Remaining Active Fleet	146	157	-11
Dolphin Vessels in the Remaining Active Fleet	73	86	-13
Remaining Active Vessels: FAD Vessel Countries	131	143	-12
Remaining Active Vessels: Dolphin Vessel Countries	58	66	-8
Remaining Active Vessels: Mixed Vessel Countries	30	34	-4

Table B-37. Primary Buyback Results: $3 Million Minimum Bid | Reduce Capacity by 60,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$117,491,865
Total Annual Loan Payment ($)	$13,800,550
Annual Average Loan Payment ($) per Active Vessel	$59,230
Annual Average Loan Payment ($) per m³ of Remaining Fleet	$61.93
Loan Payment Fee as Percent of Future Total Revenue (%)	1.59%
Number of Vessels Bought Out	38
Number of Active Vessels Remaining: 67 Latent Vessels Remain	233
Capacity Removed (m³)	60,968
Capacity Remaining (m³)	222,837
Estimated Closure Days After the Buyback	30
Average NOR Gain per Vessel less Average Buyback Loan Payment	$107,522
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$173,781
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$140,135

Table B-38. Detailed Buyback Results: $3 Million Minimum Bid | Reduce Capacity by 60,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m³)	222,837	283,805	-60,968
Total Cost of Buyback	$117,491,865	$0	$117,491,865
Number of Vessels Remaining (Active + Latent)	233	271	-38
Buyback Cost per Vessel Removed	$3,091,891	$0	$3,091,891
Buyback Cost per Remaining Active Vessel	$1,897,137	0	$1,897,137
Average Capacity of Vessels Selling (m³)	1,604	0	1,604
Estimated Closure Days After the Buyback	30	62	-32
BET Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
YFT Harvested by Remaining Fleet as a % of SQ	90.4%	100.0%	-9.6%
SKJ Harvested by Remaining Fleet as a % of SQ	101.1%	100.0%	1.1%
Additional Revenue/Remaining Active Vessels from BET	$36,221	$0	$36,221
Additional Revenue/Remaining Active Vessels from YFT	$141,710	$0	$141,710
Additional Revenue/Remaining Active Vessels from SKJ	$168,127	$0	$168,127
Total Additional Revenue/Remaining Active Vessels	$346,058	$0	$346,058
Estimated Total Fleet Revenue per Year	$868,901,407	$937,723,098	($68,821,691)
Average Revenue/Active Vessel Remaining in the Fleet	$3,729,191	$3,383,133	$346,058
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	110%	100%	10%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,225,841	$1,059,090	$166,752
Net Operating Revenue/Active Vessel as a % of SQ	116%	100%	16%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	7	24	-17
Profitable Vessels in the Remaining Active Fleet	198	219	-21
Vessels Assumed to Sell Out at the Minimum Bid	30	0	30
FAD Vessels in the Remaining Active Fleet	142	157	-15
Dolphin Vessels in the Remaining Active Fleet	63	86	-23
Remaining Active Vessels: FAD Vessel Countries	128	143	-15
Remaining Active Vessels: Dolphin Vessel Countries	50	66	-16

Remaining Active Vessels: Mixed Vessel Countries	27	34	-7

Table B-39. Primary Buyback Results: \$3 Million Minimum Bid | Reduce Capacity by 80,000 m^3

Total Cost of the Buyback = Total Loan Amount (\$) (Assumes Grant = \$0)	\$169,957,045
Total Annual Loan Payment (\$)	\$19,963,091
Annual Average Loan Payment (\$) per Active Vessel	\$92,422
Annual Average Loan Payment (\$) per m^3 of Remaining Fleet	\$98.08
Loan Payment Fee as Percent of Future Total Revenue (%)	2.35%
Number of Vessels Bought Out	55
Number of Active Vessels Remaining: 67 Latent Vessels Remain	216
Capacity Removed (m^3)	80,267
Capacity Remaining (m^3)	203,538
Estimated Closure Days After the Buyback	17
Average NOR Gain per Vessel less Average Buyback Loan Payment	\$161,587
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	\$248,268
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	\$295,571

Table B-40. Detailed Buyback Results: \$3 Million Minimum Bid | Reduce Capacity by 80,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	203,538	283,805	-80,267
Total Cost of Buyback	\$169,957,045	\$0	\$169,957,045
Number of Vessels Remaining (Active + Latent)	216	271	-55
Buyback Cost per Vessel Removed	\$3,090,128	\$0	\$3,090,128
Buyback Cost per Remaining Active Vessel	\$1,732,835	0	\$1,732,835
Average Capacity of Vessels Selling (m^3)	1,459	0	1,459
Estimated Closure Days After the Buyback	17	62	-45
BET Harvested by Remaining Fleet as a % of SQ	99.9%	100.0%	-0.1%
YFT Harvested by Remaining Fleet as a % of SQ	85.7%	100.0%	-14.3%
SKJ Harvested by Remaining Fleet as a % of SQ	101.8%	100.0%	1.8%
Additional Revenue/Remaining Active Vessels from BET	\$52,829	\$0	\$52,829
Additional Revenue/Remaining Active Vessels from YFT	\$198,431	\$0	\$198,431
Additional Revenue/Remaining Active Vessels from SKJ	\$247,451	\$0	\$247,451
Total Additional Revenue/Remaining Active Vessels	\$498,711	\$0	\$498,711
Estimated Total Fleet Revenue per Year	\$850,198,719	\$937,723,098	(\$87,524,379)
Average Revenue/Active Vessel Remaining in the Fleet	\$3,936,105	\$3,437,394	\$498,711
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was \$3.9 million; if latent vessels are included, SQ revenue/vessel was \$3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	115%	100%	15%
Avg. Net Operating Revenue/Remaining Active Vessel	\$1,313,098	\$1,059,090	\$254,009
Net Operating Revenue/Active Vessel as a % of SQ	124%	100%	24%
Latent Vessels in the Remaining Fleet	22	28	-6
Unprofitable Vessels in the Remaining Active Fleet	5	24	-19
Profitable Vessels in the Remaining Active Fleet	189	219	-30
Vessels Assumed to Sell Out at the Minimum Bid	41	0	41
FAD Vessels in the Remaining Active Fleet	139	157	-18
Dolphin Vessels in the Remaining Active Fleet	55	86	-31

Remaining Active Vessels: FAD Vessel Countries	126	143	-17
Remaining Active Vessels: Dolphin Vessel Countries	42	66	-24
Remaining Active Vessels: Mixed Vessel Countries	26	34	-8

Table B-41. Primary Buyback Results: $3 Million Minimum Bid | Reduce Capacity by 100,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$232,987,405
Total Annual Loan Payment ($)	$27,366,613
Annual Average Loan Payment ($) per Active Vessel	$145,567
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$149.77
Loan Payment Fee as Percent of Future Total Revenue (%)	3.19%
Number of Vessels Bought Out	83
Number of Active Vessels Remaining: 67 Latent Vessels Remain	188
Capacity Removed (m^3)	101,076
Capacity Remaining (m^3)	182,729
Estimated Closure Days After the Buyback	3
Average NOR Gain per Vessel less Average Buyback Loan Payment	$224,262
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$297,969
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$160,031

Table B-42. Detailed Buyback Results: $3 Million Minimum Bid | Reduce Capacity by 100,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	182,729	283,805	-101,076
Total Cost of Buyback	$232,987,405	$0	$232,987,405
Number of Vessels Remaining (Active + Latent)	188	271	-83
Buyback Cost per Vessel Removed	$2,807,077	$0	$2,807,077
Buyback Cost per Remaining Active Vessel	$1,555,675	0	$1,555,675
Average Capacity of Vessels Selling (m^3)	1,218	0	1,218
Estimated Closure Days After the Buyback	3	62	-59
BET Harvested by Remaining Fleet as a % of SQ	99.9%	100.0%	-0.1%
YFT Harvested by Remaining Fleet as a % of SQ	87.4%	100.0%	-12.6%
SKJ Harvested by Remaining Fleet as a % of SQ	102.3%	100.0%	2.3%
Additional Revenue/Remaining Active Vessels from BET	$76,560	$0	$76,560
Additional Revenue/Remaining Active Vessels from YFT	$289,229	$0	$289,229
Additional Revenue/Remaining Active Vessels from SKJ	$360,092	$0	$360,092
Total Additional Revenue/Remaining Active Vessels	$725,882	$0	$725,882
Estimated Total Fleet Revenue per Year	$858,858,587	$937,723,098	($78,864,511)
Average Revenue/Active Vessel Remaining in the Fleet	$4,568,397	$3,842,515	$725,882
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	119%	100%	19%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,428,919	$1,059,090	$369,829
Net Operating Revenue/Active Vessel as a % of SQ	135%	100%	35%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	4	24	-20
Profitable Vessels in the Remaining Active Fleet	184	219	-35
Vessels Assumed to Sell Out at the Minimum Bid	65	0	65

FAD Vessels in the Remaining Active Fleet	134	157	-23
Dolphin Vessels in the Remaining Active Fleet	54	86	-32
Remaining Active Vessels: FAD Vessel Countries	121	143	-22
Remaining Active Vessels: Dolphin Vessel Countries	41	66	-25
Remaining Active Vessels: Mixed Vessel Countries	26	34	-8

Table B-43. Primary Buyback Results: $3 Million Minimum Bid | Reduce Capacity to 171,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$278,528,670
Total Annual Loan Payment ($)	$32,715,873
Annual Average Loan Payment ($) per Active Vessel	$183,797
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$191.90
Loan Payment Fee as Percent of Future Total Revenue (%)	3.95%
Number of Vessels Bought Out	93
Number of Active Vessels Remaining: 67 Latent Vessels Remain	178
Capacity Removed (m^3)	113,322
Capacity Remaining (m^3)	170,483
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$225,372
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$278,372
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$190,190

Table B-44. Detailed Buyback Results: $3 Million Minimum Bid | Reduce Capacity to 171,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	170,483	283,805	-113,322
Total Cost of Buyback	$278,528,670	$0	$278,528,670
Number of Vessels Remaining (Active + Latent)	178	271	-93
Buyback Cost per Vessel Removed	$2,994,932	$0	$2,994,932
Buyback Cost per Remaining Active Vessel	$1,451,418	0	$1,451,418
Average Capacity of Vessels Selling (m^3)	1,219	0	1,219
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	96.6%	100.0%	-3.4%
YFT Harvested by Remaining Fleet as a % of SQ	83.0%	100.0%	-17.0%
SKJ Harvested by Remaining Fleet as a % of SQ	99.9%	100.0%	-0.1%
Additional Revenue/Remaining Active Vessels from BET	$81,490	$0	$81,490
Additional Revenue/Remaining Active Vessels from YFT	$306,847	$0	$306,847
Additional Revenue/Remaining Active Vessels from SKJ	$386,935	$0	$386,935
Total Additional Revenue/Remaining Active Vessels	$775,272	$0	$775,272
Estimated Total Fleet Revenue per Year	$828,426,081	$937,723,098	($109,297,017)
Average Revenue/Active Vessel Remaining in the Fleet	$4,654,079	$3,878,807	$775,272
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,468,259	$1,059,090	$409,169
Net Operating Revenue/Active Vessel as a % of SQ	139%	100%	39%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	2	24	-22

Profitable Vessels in the Remaining Active Fleet	176	219	-43
Vessels Assumed to Sell Out at the Minimum Bid	69	0	69
FAD Vessels in the Remaining Active Fleet	129	157	-28
Dolphin Vessels in the Remaining Active Fleet	49	86	-37
Remaining Active Vessels: FAD Vessel Countries	117	143	-26
Remaining Active Vessels: Dolphin Vessel Countries	37	66	-29
Remaining Active Vessels: Mixed Vessel Countries	24	34	-10

Table B-45. Primary Buyback Results: $3 Million Minimum Bid | Reduce Capacity to 158,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$345,873,088
Total Annual Loan Payment ($)	$40,626,123
Annual Average Loan Payment ($) per Active Vessel	$244,736
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$259.19
Loan Payment Fee as Percent of Future Total Revenue (%)	5.21%
Number of Vessels Bought Out	105
Number of Active Vessels Remaining: 67 Latent Vessels Remain	166
Capacity Removed (m^3)	127,064
Capacity Remaining (m^3)	156,741
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$174,237
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$213,048
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$212,983

Table B-46. Detailed Buyback Results: $3 Million Minimum Bid | Reduce Capacity to 158,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	156,741	283,805	-127,064
Total Cost of Buyback	$345,873,088	$0	$345,873,088
Number of Vessels Remaining (Active + Latent)	166	271	-105
Buyback Cost per Vessel Removed	$3,294,029	$0	$3,294,029
Buyback Cost per Remaining Active Vessel	$1,334,424	0	$1,334,424
Average Capacity of Vessels Selling (m^3)	1,210	0	1,210
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	95.5%	100.0%	-4.5%
YFT Harvested by Remaining Fleet as a % of SQ	73.5%	100.0%	-26.5%
SKJ Harvested by Remaining Fleet as a % of SQ	97.3%	100.0%	-2.7%
Additional Revenue/Remaining Active Vessels from BET	$86,344	$0	$86,344
Additional Revenue/Remaining Active Vessels from YFT	$287,150	$0	$287,150
Additional Revenue/Remaining Active Vessels from SKJ	$404,033	$0	$404,033
Total Additional Revenue/Remaining Active Vessels	$777,527	$0	$777,527
Estimated Total Fleet Revenue per Year	$779,823,392	$937,723,098	($157,899,706)
Average Revenue/Active Vessel Remaining in the Fleet	$4,697,731	$3,920,204	$777,527
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,478,062	$1,059,090	$418,973
Net Operating Revenue/Active Vessel as a % of SQ	140%	100%	40%

Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	0	24	-24
Profitable Vessels in the Remaining Active Fleet	166	219	-53
Vessels Assumed to Sell Out at the Minimum Bid	71	0	71
FAD Vessels in the Remaining Active Fleet	125	157	-32
Dolphin Vessels in the Remaining Active Fleet	41	86	-45
Remaining Active Vessels: FAD Vessel Countries	114	143	-29
Remaining Active Vessels: Dolphin Vessel Countries	31	66	-35
Remaining Active Vessels: Mixed Vessel Countries	21	34	-13

Table B-47. Primary Buyback Results: $3 Million Minimum Bid | Reduce Capacity to Eliminate Closure

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$256,597,338
Total Annual Loan Payment ($)	$30,139,827
Annual Average Loan Payment ($) per Active Vessel	$164,699
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$171.21
Loan Payment Fee as Percent of Future Total Revenue (%)	3.55%
Number of Vessels Bought Out	88
Number of Active Vessels Remaining: 67 Latent Vessels Remain	183
Capacity Removed (m^3)	107,762
Capacity Remaining (m^3)	176,043
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$230,613
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$295,966
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$181,573

Table B-48. Detailed Buyback Results: $3 Million Minimum Bid | Reduce Capacity to Eliminate Closure

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	176,043	283,805	-107,762
Total Cost of Buyback	$256,597,338	$0	$256,597,338
Number of Vessels Remaining (Active + Latent)	183	271	-88
Buyback Cost per Vessel Removed	$2,915,879	$0	$2,915,879
Buyback Cost per Remaining Active Vessel	$1,498,753	0	$1,498,753
Average Capacity of Vessels Selling (m^3)	1,225	0	1,225
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	100.4%	100.0%	0.4%
YFT Harvested by Remaining Fleet as a % of SQ	84.8%	100.0%	-15.2%
SKJ Harvested by Remaining Fleet as a % of SQ	102.1%	100.0%	2.1%
Additional Revenue/Remaining Active Vessels from BET	$81,688	$0	$81,688
Additional Revenue/Remaining Active Vessels from YFT	$302,943	$0	$302,943
Additional Revenue/Remaining Active Vessels from SKJ	$382,829	$0	$382,829
Total Additional Revenue/Remaining Active Vessels	$767,459	$0	$767,459
Estimated Total Fleet Revenue per Year	$848,091,546	$937,723,098	($89,631,551)
Average Revenue/Active Vessel Remaining in the Fleet	$4,634,380	$3,866,921	$767,459
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%

Avg. Net Operating Revenue/Remaining Active Vessel	$1,454,402	$1,059,090	$395,312
Net Operating Revenue/Active Vessel as a % of SQ	137%	100%	37%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	2	24	-22
Profitable Vessels in the Remaining Active Fleet	181	219	-38
Vessels Assumed to Sell Out at the Minimum Bid	67	0	67
FAD Vessels in the Remaining Active Fleet	132	157	-25
Dolphin Vessels in the Remaining Active Fleet	51	86	-35
Remaining Active Vessels: FAD Vessel Countries	119	143	-24
Remaining Active Vessels: Dolphin Vessel Countries	38	66	-28
Remaining Active Vessels: Mixed Vessel Countries	26	34	-8

Buyback Results under Scenario 4

Table B-49. Primary Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity by 20,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$30,647,000
Total Annual Loan Payment ($)	$3,599,785
Annual Average Loan Payment ($) per Active Vessel	$15,062
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$13.65
Loan Payment Fee as Percent of Future Total Revenue (%)	0.40%
Number of Vessels Bought Out	32
Number of Active Vessels Remaining: 67 Latent Vessels Remain	239
Capacity Removed (m^3)	20,117
Capacity Remaining (m^3)	263,688
Estimated Closure Days After the Buyback	61
Average NOR Gain per Vessel less Average Buyback Loan Payment	($8,588)
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	($7,056)
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	($10,917)

Table B-50. Detailed Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity by 20,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	263,688	283,805	-20,117
Total Cost of Buyback	$30,647,000	$0	$30,647,000
Number of Vessels Remaining (Active + Latent)	239	271	-32
Buyback Cost per Vessel Removed	$957,719	$0	$957,719
Buyback Cost per Remaining Active Vessel	$2,244,925	0	$2,244,925
Average Capacity of Vessels Selling (m^3)	629	0	629
Estimated Closure Days After the Buyback	61	62	-1
BET Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
YFT Harvested by Remaining Fleet as a % of SQ	98.5%	100.0%	-1.5%
SKJ Harvested by Remaining Fleet as a % of SQ	99.9%	100.0%	-0.1%
Additional Revenue/Remaining Active Vessels from BET	$1,508	$0	$1,508
Additional Revenue/Remaining Active Vessels from YFT	$6,492	$0	$6,492
Additional Revenue/Remaining Active Vessels from SKJ	$6,913	$0	$6,913
Total Additional Revenue/Remaining Active Vessels	$14,913	$0	$14,913
Estimated Total Fleet Revenue per Year	$901,124,943	$937,723,098	($36,598,154)

Average Revenue/Active Vessel Remaining in the Fleet	$3,770,397	$3,755,484	$14,913
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	100%	100%	0%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,065,563	$1,059,090	$6,473
Net Operating Revenue/Active Vessel as a % of SQ	101%	100%	1%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	21	24	-3
Profitable Vessels in the Remaining Active Fleet	218	219	-1
Vessels Assumed to Sell Out at the Minimum Bid	32	0	32
FAD Vessels in the Remaining Active Fleet	156	157	-1
Dolphin Vessels in the Remaining Active Fleet	83	86	-3
Remaining Active Vessels: FAD Vessel Countries	142	143	-1
Remaining Active Vessels: Dolphin Vessel Countries	63	66	-3
Remaining Active Vessels: Mixed Vessel Countries	34	34	0

Table B-51. Primary Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity by 40,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$72,645,000
Total Annual Loan Payment ($)	$8,532,854
Annual Average Loan Payment ($) per Active Vessel	$38,093
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$35.01
Loan Payment Fee as Percent of Future Total Revenue (%)	0.96%
Number of Vessels Bought Out	47
Number of Active Vessels Remaining: 67 Latent Vessels Remain	224
Capacity Removed (m^3)	40,064
Capacity Remaining (m^3)	243,741
Estimated Closure Days After the Buyback	49
Average NOR Gain per Vessel less Average Buyback Loan Payment	$31,718
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$48,061
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$6,661

Table B-52. Detailed Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity by 40,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	243,741	283,805	-40,064
Total Cost of Buyback	$72,645,000	$0	$72,645,000
Number of Vessels Remaining (Active + Latent)	224	271	-47
Buyback Cost per Vessel Removed	$1,545,638	$0	$1,545,638
Buyback Cost per Remaining Active Vessel	$2,075,105	0	$2,075,105
Average Capacity of Vessels Selling (m^3)	852	0	852
Estimated Closure Days After the Buyback	49	62	-13
BET Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
YFT Harvested by Remaining Fleet as a % of SQ	97.6%	100.0%	-2.4%
SKJ Harvested by Remaining Fleet as a % of SQ	99.5%	100.0%	-0.5%
Additional Revenue/Remaining Active Vessels from BET	$15,833	$0	$15,833
Additional Revenue/Remaining Active Vessels from YFT	$67,509	$0	$67,509
Additional Revenue/Remaining Active Vessels from SKJ	$72,351	$0	$72,351

Total Additional Revenue/Remaining Active Vessels	$155,693	$0	$155,693
Estimated Total Fleet Revenue per Year	$890,806,577	$937,723,098	($46,916,521)
Average Revenue/Active Vessel Remaining in the Fleet	$3,976,815	$3,821,122	$155,693
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	104%	100%	4%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,128,901	$1,059,090	$69,811
Net Operating Revenue/Active Vessel as a % of SQ	107%	100%	7%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	14	24	-10
Profitable Vessels in the Remaining Active Fleet	210	219	-9
Vessels Assumed to Sell Out at the Minimum Bid	47	0	47
FAD Vessels in the Remaining Active Fleet	146	157	-11
Dolphin Vessels in the Remaining Active Fleet	78	86	-8
Remaining Active Vessels: FAD Vessel Countries	133	143	-10
Remaining Active Vessels: Dolphin Vessel Countries	60	66	-6
Remaining Active Vessels: Mixed Vessel Countries	31	34	-3

Table B-53. Primary Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity by 60,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$120,776,649
Total Annual Loan Payment ($)	$14,186,380
Annual Average Loan Payment ($) per Active Vessel	$67,234
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$63.86
Loan Payment Fee as Percent of Future Total Revenue (%)	1.59%
Number of Vessels Bought Out	60
Number of Active Vessels Remaining: 67 Latent Vessels Remain	211
Capacity Removed (m^3)	61,655
Capacity Remaining (m^3)	222,150
Estimated Closure Days After the Buyback	32
Average NOR Gain per Vessel less Average Buyback Loan Payment	$107,987
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$142,621
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$54,153

Table B-54. Detailed Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity by 60,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	222,150	283,805	-61,655
Total Cost of Buyback	$120,776,649	$0	$120,776,649
Number of Vessels Remaining (Active + Latent)	211	271	-60
Buyback Cost per Vessel Removed	$2,012,944	$0	$2,012,944
Buyback Cost per Remaining Active Vessel	$1,891,288	0	$1,891,288
Average Capacity of Vessels Selling (m^3)	1,028	0	1,028
Estimated Closure Days After the Buyback	32	62	-30
BET Harvested by Remaining Fleet as a % of SQ	100.1%	100.0%	0.1%
YFT Harvested by Remaining Fleet as a % of SQ	94.9%	100.0%	-5.1%
SKJ Harvested by Remaining Fleet as a % of SQ	101.9%	100.0%	1.9%
Additional Revenue/Remaining Active Vessels from BET	$38,014	$0	$38,014

Additional Revenue/Remaining Active Vessels from YFT	$156,589	$0	$156,589
Additional Revenue/Remaining Active Vessels from SKJ	$177,889	$0	$177,889
Total Additional Revenue/Remaining Active Vessels	$372,493	$0	$372,493
Estimated Total Fleet Revenue per Year	$889,831,139	$937,723,098	($47,891,959)
Average Revenue/Active Vessel Remaining in the Fleet	$4,217,209	$3,844,717	$372,493
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	110%	100%	10%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,234,311	$1,059,090	$175,221
Net Operating Revenue/Active Vessel as a % of SQ	117%	100%	17%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	6	24	-18
Profitable Vessels in the Remaining Active Fleet	205	219	-14
Vessels Assumed to Sell Out at the Minimum Bid	57	0	57
FAD Vessels in the Remaining Active Fleet	143	157	-14
Dolphin Vessels in the Remaining Active Fleet	68	86	-18
Remaining Active Vessels: FAD Vessel Countries	129	143	-14
Remaining Active Vessels: Dolphin Vessel Countries	54	66	-12
Remaining Active Vessels: Mixed Vessel Countries	28	34	-6

Table B-55. Primary Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity by 80,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$167,580,738
Total Annual Loan Payment ($)	$19,683,971
Annual Average Loan Payment ($) per Active Vessel	$99,919
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$97.20
Loan Payment Fee as Percent of Future Total Revenue (%)	2.30%
Number of Vessels Bought Out	74
Number of Active Vessels Remaining: 67 Latent Vessels Remain	197
Capacity Removed (m^3)	81,291
Capacity Remaining (m^3)	202,514
Estimated Closure Days After the Buyback	29
Average NOR Gain per Vessel less Average Buyback Loan Payment	$109,447
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$139,681
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$60,005

Table B-56. Detailed Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity by 80,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	202,514	283,805	-81,291
Total Cost of Buyback	$167,580,738	$0	$167,580,738
Number of Vessels Remaining (Active + Latent)	197	271	-74
Buyback Cost per Vessel Removed	$2,264,605	$0	$2,264,605
Buyback Cost per Remaining Active Vessel	$1,724,116	0	$1,724,116
Average Capacity of Vessels Selling (m^3)	1,099	0	1,099
Estimated Closure Days After the Buyback	29	62	-33
BET Harvested by Remaining Fleet as a % of SQ	100.1%	100.0%	0.1%
YFT Harvested by Remaining Fleet as a % of SQ	87.3%	100.0%	-12.7%

SKJ Harvested by Remaining Fleet as a % of SQ	101.4%	100.0%	1.4%
Additional Revenue/Remaining Active Vessels from BET	$44,647	$0	$44,647
Additional Revenue/Remaining Active Vessels from YFT	$170,370	$0	$170,370
Additional Revenue/Remaining Active Vessels from SKJ	$207,552	$0	$207,552
Total Additional Revenue/Remaining Active Vessels	$422,569	$0	$422,569
Estimated Total Fleet Revenue per Year	$854,419,057	$937,723,098	($83,304,041)
Average Revenue/Active Vessel Remaining in the Fleet	$4,337,153	$3,914,584	$422,569
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	111%	100%	11%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,268,456	$1,059,090	$209,366
Net Operating Revenue/Active Vessel as a % of SQ	120%	100%	20%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	1	24	-23
Profitable Vessels in the Remaining Active Fleet	196	219	-23
Vessels Assumed to Sell Out at the Minimum Bid	70	0	70
FAD Vessels in the Remaining Active Fleet	138	157	-19
Dolphin Vessels in the Remaining Active Fleet	59	86	-27
Remaining Active Vessels: FAD Vessel Countries	124	143	-19
Remaining Active Vessels: Dolphin Vessel Countries	45	66	-21
Remaining Active Vessels: Mixed Vessel Countries	28	34	-6

Table B-57. Primary Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity by 100,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$220,462,421
Total Annual Loan Payment ($)	$25,895,433
Annual Average Loan Payment ($) per Active Vessel	$141,505
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$141.68
Loan Payment Fee as Percent of Future Total Revenue (%)	3.05%
Number of Vessels Bought Out	88
Number of Active Vessels Remaining: 67 Latent Vessels Remain	183
Capacity Removed (m^3)	101,032
Capacity Remaining (m^3)	182,773
Estimated Closure Days After the Buyback	9
Average NOR Gain per Vessel less Average Buyback Loan Payment	$204,749
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$250,208
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$136,733

Table B-58. Detailed Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity by 100,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	182,773	283,805	-101,032
Total Cost of Buyback	$220,462,421	$0	$220,462,421
Number of Vessels Remaining (Active + Latent)	183	271	-88
Buyback Cost per Vessel Removed	$2,505,255	$0	$2,505,255
Buyback Cost per Remaining Active Vessel	$1,556,050	0	$1,556,050
Average Capacity of Vessels Selling (m^3)	1,148	0	1,148
Estimated Closure Days After the Buyback	9	62	-53

BET Harvested by Remaining Fleet as a % of SQ	100.2%	100.0%	0.2%
YFT Harvested by Remaining Fleet as a % of SQ	85.5%	100.0%	-14.5%
SKJ Harvested by Remaining Fleet as a % of SQ	102.0%	100.0%	2.0%
Additional Revenue/Remaining Active Vessels from BET	$71,637	$0	$71,637
Additional Revenue/Remaining Active Vessels from YFT	$266,283	$0	$266,283
Additional Revenue/Remaining Active Vessels from SKJ	$334,904	$0	$334,904
Total Additional Revenue/Remaining Active Vessels	$672,824	$0	$672,824
Estimated Total Fleet Revenue per Year	$849,644,009	$937,723,098	($88,079,088)
Average Revenue/Active Vessel Remaining in the Fleet	$4,642,863	$3,970,039	$672,824
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	117%	100%	17%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,405,344	$1,059,090	$346,254
Net Operating Revenue/Active Vessel as a % of SQ	133%	100%	33%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-2	24	-26
Profitable Vessels in the Remaining Active Fleet	185	219	-34
Vessels Assumed to Sell Out at the Minimum Bid	75	0	75
FAD Vessels in the Remaining Active Fleet	130	157	-27
Dolphin Vessels in the Remaining Active Fleet	53	86	-33
Remaining Active Vessels: FAD Vessel Countries	117	143	-26
Remaining Active Vessels: Dolphin Vessel Countries	40	66	-26
Remaining Active Vessels: Mixed Vessel Countries	26	34	-8

Table B-59. Primary Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity to 171,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$261,891,128
Total Annual Loan Payment ($)	$30,761,634
Annual Average Loan Payment ($) per Active Vessel	$175,781
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$180.38
Loan Payment Fee as Percent of Future Total Revenue (%)	3.70%
Number of Vessels Bought Out	96
Number of Active Vessels Remaining: 67 Latent Vessels Remain	175
Capacity Removed (m^3)	113,269
Capacity Remaining (m^3)	170,536
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$235,910
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$289,377
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$155,932

Table B-60. Detailed Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity to 171,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	170,536	283,805	-113,269
Total Cost of Buyback	$261,891,128	$0	$261,891,128
Number of Vessels Remaining (Active + Latent)	175	271	-96
Buyback Cost per Vessel Removed	$2,728,033	$0	$2,728,033
Buyback Cost per Remaining Active Vessel	$1,451,869	0	$1,451,869

Average Capacity of Vessels Selling (m³)	1,180	0	1,180
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	98.5%	100.0%	-1.5%
YFT Harvested by Remaining Fleet as a % of SQ	83.0%	100.0%	-17.0%
SKJ Harvested by Remaining Fleet as a % of SQ	100.6%	100.0%	0.6%
Additional Revenue/Remaining Active Vessels from BET	$82,927	$0	$82,927
Additional Revenue/Remaining Active Vessels from YFT	$311,331	$0	$311,331
Additional Revenue/Remaining Active Vessels from SKJ	$394,096	$0	$394,096
Total Additional Revenue/Remaining Active Vessels	$788,353	$0	$788,353
Estimated Total Fleet Revenue per Year	$832,432,970	$937,723,098	($105,290,128)
Average Revenue/Active Vessel Remaining in the Fleet	$4,756,760	$3,968,406	$788,353
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,470,780	$1,059,090	$411,691
Net Operating Revenue/Active Vessel as a % of SQ	139%	100%	39%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-2	24	-26
Profitable Vessels in the Remaining Active Fleet	177	219	-42
Vessels Assumed to Sell Out at the Minimum Bid	76	0	76
FAD Vessels in the Remaining Active Fleet	126	157	-31
Dolphin Vessels in the Remaining Active Fleet	49	86	-37
Remaining Active Vessels: FAD Vessel Countries	114	143	-29
Remaining Active Vessels: Dolphin Vessel Countries	36	66	-30
Remaining Active Vessels: Mixed Vessel Countries	25	34	-9

Table B-61. Primary Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity to 158,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$321,716,645
Total Annual Loan Payment ($)	$37,788,716
Annual Average Loan Payment ($) per Active Vessel	$230,419
Annual Average Loan Payment ($) per m³ of Remaining Fleet	$239.69
Loan Payment Fee as Percent of Future Total Revenue (%)	4.80%
Number of Vessels Bought Out	107
Number of Active Vessels Remaining: 67 Latent Vessels Remain	164
Capacity Removed (m³)	126,146
Capacity Remaining (m³)	157,659
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$194,345
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$246,242
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$111,348

Table B-62. Detailed Buyback Results: Minimum Bid Increases with Capacity | Reduce Capacity to 158,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m³)	157,659	283,805	-126,146
Total Cost of Buyback	$321,716,645	$0	$321,716,645
Number of Vessels Remaining (Active + Latent)	164	271	-107

Buyback Cost per Vessel Removed	$3,006,698	$0	$3,006,698
Buyback Cost per Remaining Active Vessel	$1,342,240	0	$1,342,240
Average Capacity of Vessels Selling (m^3)	1,179	0	1,179
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	94.9%	100.0%	-5.1%
YFT Harvested by Remaining Fleet as a % of SQ	75.4%	100.0%	-24.6%
SKJ Harvested by Remaining Fleet as a % of SQ	97.6%	100.0%	-2.4%
Additional Revenue/Remaining Active Vessels from BET	$86,894	$0	$86,894
Additional Revenue/Remaining Active Vessels from YFT	$298,525	$0	$298,525
Additional Revenue/Remaining Active Vessels from SKJ	$410,046	$0	$410,046
Total Additional Revenue/Remaining Active Vessels	$795,465	$0	$795,465
Estimated Total Fleet Revenue per Year	$787,685,640	$937,723,098	($150,037,458)
Average Revenue/Active Vessel Remaining in the Fleet	$4,802,961	$4,007,496	$795,465
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,483,854	$1,059,090	$424,764
Net Operating Revenue/Active Vessel as a % of SQ	140%	100%	40%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-2	24	-26
Profitable Vessels in the Remaining Active Fleet	166	219	-53
Vessels Assumed to Sell Out at the Minimum Bid	76	0	76
FAD Vessels in the Remaining Active Fleet	121	157	-36
Dolphin Vessels in the Remaining Active Fleet	43	86	-43
Remaining Active Vessels: FAD Vessel Countries	111	143	-32
Remaining Active Vessels: Dolphin Vessel Countries	31	66	-35
Remaining Active Vessels: Mixed Vessel Countries	22	34	-12

Table B-63. Primary Buyback Results: Min. Bid Increases with Capacity | Reduce Capacity to Eliminate Closure

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$229,756,844
Total Annual Loan Payment ($)	$26,987,153
Annual Average Loan Payment ($) per Active Vessel	$149,100
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$150.16
Loan Payment Fee as Percent of Future Total Revenue (%)	3.13%
Number of Vessels Bought Out	90
Number of Active Vessels Remaining: 67 Latent Vessels Remain	181
Capacity Removed (m^3)	104,083
Capacity Remaining (m^3)	179,722
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$254,409
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$313,258
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$179,509

Table B-64. Detailed Buyback Results: Min. Bid Increases with Capacity | Reduce Capacity to Eliminate Closure

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	179,722	283,805	-104,083

Total Cost of Buyback	$229,756,844	$0	$229,756,844
Number of Vessels Remaining (Active + Latent)	181	271	-90
Buyback Cost per Vessel Removed	$2,552,854	$0	$2,552,854
Buyback Cost per Remaining Active Vessel	$1,530,075	0	$1,530,075
Average Capacity of Vessels Selling (m^3)	1,156	0	1,156
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	101.6%	100.0%	1.6%
YFT Harvested by Remaining Fleet as a % of SQ	86.8%	100.0%	-13.2%
SKJ Harvested by Remaining Fleet as a % of SQ	103.4%	100.0%	3.4%
Additional Revenue/Remaining Active Vessels from BET	$82,879	$0	$82,879
Additional Revenue/Remaining Active Vessels from YFT	$314,108	$0	$314,108
Additional Revenue/Remaining Active Vessels from SKJ	$388,536	$0	$388,536
Total Additional Revenue/Remaining Active Vessels	$785,524	$0	$785,524
Estimated Total Fleet Revenue per Year	$861,583,824	$937,723,098	($76,139,274)
Average Revenue/Active Vessel Remaining in the Fleet	$4,760,132	$3,974,608	$785,524
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,462,599	$1,059,090	$403,509
Net Operating Revenue/Active Vessel as a % of SQ	138%	100%	38%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-2	24	-26
Profitable Vessels in the Remaining Active Fleet	183	219	-36
Vessels Assumed to Sell Out at the Minimum Bid	75	0	75
FAD Vessels in the Remaining Active Fleet	129	157	-28
Dolphin Vessels in the Remaining Active Fleet	52	86	-34
Remaining Active Vessels: FAD Vessel Countries	116	143	-27
Remaining Active Vessels: Dolphin Vessel Countries	39	66	-27
Remaining Active Vessels: Mixed Vessel Countries	26	34	-8

Buyback Results under Scenario 5

Table B-65. Primary Buyback Results: Bids Increases with m³ & Weighted by DAS | Reduce Capacity by 20,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$34,608,247
Total Annual Loan Payment ($)	$4,065,072
Annual Average Loan Payment ($) per Active Vessel	$17,009
Annual Average Loan Payment ($) per m³ of Remaining Fleet	$15.43
Loan Payment Fee as Percent of Future Total Revenue (%)	0.45%
Number of Vessels Bought Out	32
Number of Active Vessels Remaining: 67 Latent Vessels Remain	239
Capacity Removed (m³)	20,376
Capacity Remaining (m³)	263,429
Estimated Closure Days After the Buyback	62
Average NOR Gain per Vessel less Average Buyback Loan Payment	($16,828)
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	($16,783)
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	($16,896)

Table B-66. Detailed Buyback Results: Bids Increases with m3 & Weighted by DAS | Reduce Capacity by 20,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m³)	263,429	283,805	-20,376
Total Cost of Buyback	$34,608,247	$0	$34,608,247
Number of Vessels Remaining (Active + Latent)	239	271	-32
Buyback Cost per Vessel Removed	$1,081,508	$0	$1,081,508
Buyback Cost per Remaining Active Vessel	$2,242,720	0	$2,242,720
Average Capacity of Vessels Selling (m³)	637	0	637
Estimated Closure Days After the Buyback	62	62	0
BET Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
YFT Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
SKJ Harvested by Remaining Fleet as a % of SQ	99.8%	100.0%	-0.2%
Additional Revenue/Remaining Active Vessels from BET	$42	$0	$42
Additional Revenue/Remaining Active Vessels from YFT	$184	$0	$184
Additional Revenue/Remaining Active Vessels from SKJ	$192	$0	$192
Total Additional Revenue/Remaining Active Vessels	$418	$0	$418
Estimated Total Fleet Revenue per Year	$906,499,555	$937,723,098	($31,223,543)
Average Revenue/Active Vessel Remaining in the Fleet	$3,792,885	$3,792,467	$418
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	100%	100%	0%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,059,270	$1,059,090	$180
Net Operating Revenue/Active Vessel as a % of SQ	100%	100%	0%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	21	24	-3
Profitable Vessels in the Remaining Active Fleet	218	219	-1
Vessels Assumed to Sell Out at the Minimum Bid	31	0	31
FAD Vessels in the Remaining Active Fleet	153	157	-4
Dolphin Vessels in the Remaining Active Fleet	86	86	0

Remaining Active Vessels: FAD Vessel Countries	139	143	-4
Remaining Active Vessels: Dolphin Vessel Countries	66	66	0
Remaining Active Vessels: Mixed Vessel Countries	34	34	0

Table B-67. Primary Buyback Results: Bids Increases with m³ & Weighted by DAS | Reduce Capacity by 40,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$98,421,493
Total Annual Loan Payment ($)	$11,560,552
Annual Average Loan Payment ($) per Active Vessel	$51,153
Annual Average Loan Payment ($) per m³ of Remaining Fleet	$47.50
Loan Payment Fee as Percent of Future Total Revenue (%)	1.29%
Number of Vessels Bought Out	45
Number of Active Vessels Remaining: 67 Latent Vessels Remain	226
Capacity Removed (m³)	40,408
Capacity Remaining (m³)	243,397
Estimated Closure Days After the Buyback	60
Average NOR Gain per Vessel less Average Buyback Loan Payment	($42,037)
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	($39,488)
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	($45,513)

Table B-68. Detailed Buyback Results: Bids Increases with m³ & Weighted by DAS | Reduce Capacity by 40,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m³)	243,397	283,805	-40,408
Total Cost of Buyback	$98,421,493	$0	$98,421,493
Number of Vessels Remaining (Active + Latent)	226	271	-45
Buyback Cost per Vessel Removed	$2,187,144	$0	$2,187,144
Buyback Cost per Remaining Active Vessel	$2,072,176	0	$2,072,176
Average Capacity of Vessels Selling (m³)	898	0	898
Estimated Closure Days After the Buyback	60	62	-2
BET Harvested by Remaining Fleet as a % of SQ	100.1%	100.0%	0.1%
YFT Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
SKJ Harvested by Remaining Fleet as a % of SQ	98.3%	100.0%	-1.7%
Additional Revenue/Remaining Active Vessels from BET	$2,141	$0	$2,141
Additional Revenue/Remaining Active Vessels from YFT	$9,401	$0	$9,401
Additional Revenue/Remaining Active Vessels from SKJ	$9,654	$0	$9,654
Total Additional Revenue/Remaining Active Vessels	$21,196	$0	$21,196
Estimated Total Fleet Revenue per Year	$897,997,245	$937,723,098	($39,725,853)
Average Revenue/Active Vessel Remaining in the Fleet	$3,973,439	$3,952,243	$21,196
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	101%	100%	1%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,068,206	$1,059,090	$9,116
Net Operating Revenue/Active Vessel as a % of SQ	101%	100%	1%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	17	24	-7
Profitable Vessels in the Remaining Active Fleet	209	219	-10
Vessels Assumed to Sell Out at the Minimum Bid	40	0	40

FAD Vessels in the Remaining Active Fleet	142	157	-15
Dolphin Vessels in the Remaining Active Fleet	84	86	-2
Remaining Active Vessels: FAD Vessel Countries	128	143	-15
Remaining Active Vessels: Dolphin Vessel Countries	64	66	-2
Remaining Active Vessels: Mixed Vessel Countries	34	34	0

Table B-69. Primary Buyback Results: Bids Increases with m³ & Weighted by DAS | Reduce Capacity by 60,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$155,075,865
Total Annual Loan Payment ($)	$18,215,153
Annual Average Loan Payment ($) per Active Vessel	$85,921
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$81.87
Loan Payment Fee as Percent of Future Total Revenue (%)	2.04%
Number of Vessels Bought Out	59
Number of Active Vessels Remaining: 67 Latent Vessels Remain	212
Capacity Removed (m^3)	61,325
Capacity Remaining (m^3)	222,480
Estimated Closure Days After the Buyback	48
Average NOR Gain per Vessel less Average Buyback Loan Payment	($6,879)
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$13,768
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	($36,377)

Table B-70. Detailed Buyback Results: Bids Increases with m³ & Weighted by DAS | Reduce Capacity by 60,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	222,480	283,805	-61,325
Total Cost of Buyback	$155,075,865	$0	$155,075,865
Number of Vessels Remaining (Active + Latent)	212	271	-59
Buyback Cost per Vessel Removed	$2,628,404	$0	$2,628,404
Buyback Cost per Remaining Active Vessel	$1,894,098	0	$1,894,098
Average Capacity of Vessels Selling (m^3)	1,039	0	1,039
Estimated Closure Days After the Buyback	48	62	-14
BET Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
YFT Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
SKJ Harvested by Remaining Fleet as a % of SQ	98.0%	100.0%	-2.0%
Additional Revenue/Remaining Active Vessels from BET	$18,147	$0	$18,147
Additional Revenue/Remaining Active Vessels from YFT	$79,329	$0	$79,329
Additional Revenue/Remaining Active Vessels from SKJ	$81,751	$0	$81,751
Total Additional Revenue/Remaining Active Vessels	$179,227	$0	$179,227
Estimated Total Fleet Revenue per Year	$894,678,425	$937,723,098	($43,044,673)
Average Revenue/Active Vessel Remaining in the Fleet	$4,220,181	$4,040,954	$179,227
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	104%	100%	4%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,138,132	$1,059,090	$79,042
Net Operating Revenue/Active Vessel as a % of SQ	107%	100%	7%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	10	24	-14

Profitable Vessels in the Remaining Active Fleet	202	219	-17
Vessels Assumed to Sell Out at the Minimum Bid	51	0	51
FAD Vessels in the Remaining Active Fleet	134	157	-23
Dolphin Vessels in the Remaining Active Fleet	78	86	-8
Remaining Active Vessels: FAD Vessel Countries	120	143	-23
Remaining Active Vessels: Dolphin Vessel Countries	60	66	-6
Remaining Active Vessels: Mixed Vessel Countries	32	34	-2

Table B-71. Primary Buyback Results: Bids Increases with m³ & Weighted by DAS | Reduce Capacity by 80,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$199,908,614
Total Annual Loan Payment ($)	$23,481,191
Annual Average Loan Payment ($) per Active Vessel	$118,592
Annual Average Loan Payment ($) per m³ of Remaining Fleet	$115.31
Loan Payment Fee as Percent of Future Total Revenue (%)	2.68%
Number of Vessels Bought Out	73
Number of Active Vessels Remaining: 67 Latent Vessels Remain	198
Capacity Removed (m³)	80,175
Capacity Remaining (m³)	203,630
Estimated Closure Days After the Buyback	33
Average NOR Gain per Vessel less Average Buyback Loan Payment	$56,019
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$96,069
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	($2,188)

Table B-72. Detailed Buyback Results: Bids Increases with m³ & Weighted by DAS | Reduce Capacity by 80,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m³)	203,630	283,805	-80,175
Total Cost of Buyback	$199,908,614	$0	$199,908,614
Number of Vessels Remaining (Active + Latent)	198	271	-73
Buyback Cost per Vessel Removed	$2,738,474	$0	$2,738,474
Buyback Cost per Remaining Active Vessel	$1,733,617	0	$1,733,617
Average Capacity of Vessels Selling (m³)	1,098	0	1,098
Estimated Closure Days After the Buyback	33	62	-29
BET Harvested by Remaining Fleet as a % of SQ	100.8%	100.0%	0.8%
YFT Harvested by Remaining Fleet as a % of SQ	95.2%	100.0%	-4.8%
SKJ Harvested by Remaining Fleet as a % of SQ	99.9%	100.0%	-0.1%
Additional Revenue/Remaining Active Vessels from BET	$39,062	$0	$39,062
Additional Revenue/Remaining Active Vessels from YFT	$162,450	$0	$162,450
Additional Revenue/Remaining Active Vessels from SKJ	$178,630	$0	$178,630
Total Additional Revenue/Remaining Active Vessels	$380,142	$0	$380,142
Estimated Total Fleet Revenue per Year	$877,511,993	$937,723,098	($60,211,105)
Average Revenue/Active Vessel Remaining in the Fleet	$4,431,879	$4,051,737	$380,142
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	109%	100%	9%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,233,701	$1,059,090	$174,611
Net Operating Revenue/Active Vessel as a % of SQ	116%	100%	16%

Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	6	24	-18
Profitable Vessels in the Remaining Active Fleet	192	219	-27
Vessels Assumed to Sell Out at the Minimum Bid	60	0	60
FAD Vessels in the Remaining Active Fleet	130	157	-27
Dolphin Vessels in the Remaining Active Fleet	68	86	-18
Remaining Active Vessels: FAD Vessel Countries	116	143	-27
Remaining Active Vessels: Dolphin Vessel Countries	50	66	-16
Remaining Active Vessels: Mixed Vessel Countries	32	34	-2

Table B-73. Primary Buyback Results: Bids Increases with m^3 & Weighted by DAS | Reduce Capacity by 100,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$262,939,008
Total Annual Loan Payment ($)	$30,884,717
Annual Average Loan Payment ($) per Active Vessel	$167,852
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$169.01
Loan Payment Fee as Percent of Future Total Revenue (%)	3.58%
Number of Vessels Bought Out	87
Number of Active Vessels Remaining: 67 Latent Vessels Remain	184
Capacity Removed (m^3)	101,065
Capacity Remaining (m^3)	182,740
Estimated Closure Days After the Buyback	17
Average NOR Gain per Vessel less Average Buyback Loan Payment	$117,799
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$171,123
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$39,153

Table B-74. Detailed Buyback Results: Bids Increases with m^3 & Weighted by DAS | Reduce Capacity by 100,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	182,740	283,805	-101,065
Total Cost of Buyback	$262,939,008	$0	$262,939,008
Number of Vessels Remaining (Active + Latent)	184	271	-87
Buyback Cost per Vessel Removed	$3,022,287	$0	$3,022,287
Buyback Cost per Remaining Active Vessel	$1,555,769	0	$1,555,769
Average Capacity of Vessels Selling (m^3)	1,162	0	1,162
Estimated Closure Days After the Buyback	17	62	-45
BET Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
YFT Harvested by Remaining Fleet as a % of SQ	90.3%	100.0%	-9.7%
SKJ Harvested by Remaining Fleet as a % of SQ	101.1%	100.0%	1.1%
Additional Revenue/Remaining Active Vessels from BET	$61,666	$0	$61,666
Additional Revenue/Remaining Active Vessels from YFT	$240,684	$0	$240,684
Additional Revenue/Remaining Active Vessels from SKJ	$286,740	$0	$286,740
Total Additional Revenue/Remaining Active Vessels	$589,090	$0	$589,090
Estimated Total Fleet Revenue per Year	$861,860,660	$937,723,098	($75,862,438)
Average Revenue/Active Vessel Remaining in the Fleet	$4,684,025	$4,094,935	$589,090
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	114%	100%	14%

Avg. Net Operating Revenue/Remaining Active Vessel	$1,344,741	$1,059,090	$285,651
Net Operating Revenue/Active Vessel as a % of SQ	127%	100%	27%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-1	24	-25
Profitable Vessels in the Remaining Active Fleet	185	219	-34
Vessels Assumed to Sell Out at the Minimum Bid	71	0	71
FAD Vessels in the Remaining Active Fleet	125	157	-32
Dolphin Vessels in the Remaining Active Fleet	59	86	-27
Remaining Active Vessels: FAD Vessel Countries	112	143	-31
Remaining Active Vessels: Dolphin Vessel Countries	43	66	-23
Remaining Active Vessels: Mixed Vessel Countries	29	34	-5

Table B-75. Primary Buyback Results: Bids Increases with m³ & Weighted by DAS | Reduce Capacity to 171,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$300,901,134
Total Annual Loan Payment ($)	$35,343,734
Annual Average Loan Payment ($) per Active Vessel	$203,125
Annual Average Loan Payment ($) per m³ of Remaining Fleet	$208.21
Loan Payment Fee as Percent of Future Total Revenue (%)	4.26%
Number of Vessels Bought Out	97
Number of Active Vessels Remaining: 67 Latent Vessels Remain	174
Capacity Removed (m³)	114,058
Capacity Remaining (m³)	169,747
Estimated Closure Days After the Buyback	13
Average NOR Gain per Vessel less Average Buyback Loan Payment	$125,338
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$170,240
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$56,546

Table B-76. Detailed Buyback Results: Bids Increases with m³ & Weighted by DAS | Reduce Capacity to 171,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m³)	169,747	283,805	-114,058
Total Cost of Buyback	$300,901,134	$0	$300,901,134
Number of Vessels Remaining (Active + Latent)	174	271	-97
Buyback Cost per Vessel Removed	$3,102,074	$0	$3,102,074
Buyback Cost per Remaining Active Vessel	$1,445,152	0	$1,445,152
Average Capacity of Vessels Selling (m³)	1,176	0	1,176
Estimated Closure Days After the Buyback	13	62	-49
BET Harvested by Remaining Fleet as a % of SQ	100.1%	100.0%	0.1%
YFT Harvested by Remaining Fleet as a % of SQ	83.0%	100.0%	-17.0%
SKJ Harvested by Remaining Fleet as a % of SQ	100.3%	100.0%	0.3%
Additional Revenue/Remaining Active Vessels from BET	$70,488	$0	$70,488
Additional Revenue/Remaining Active Vessels from YFT	$253,617	$0	$253,617
Additional Revenue/Remaining Active Vessels from SKJ	$324,846	$0	$324,846
Total Additional Revenue/Remaining Active Vessels	$648,951	$0	$648,951
Estimated Total Fleet Revenue per Year	$830,436,182	$937,723,098	($107,286,915)
Average Revenue/Active Vessel Remaining in the Fleet	$4,772,622	$4,123,671	$648,951

Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	116%	100%	16%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,387,553	$1,059,090	$328,463
Net Operating Revenue/Active Vessel as a % of SQ	131%	100%	31%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-2	24	-26
Profitable Vessels in the Remaining Active Fleet	176	219	-43
Vessels Assumed to Sell Out at the Minimum Bid	76	0	76
FAD Vessels in the Remaining Active Fleet	124	157	-33
Dolphin Vessels in the Remaining Active Fleet	50	86	-36
Remaining Active Vessels: FAD Vessel Countries	111	143	-32
Remaining Active Vessels: Dolphin Vessel Countries	35	66	-31
Remaining Active Vessels: Mixed Vessel Countries	28	34	-6

Table B-77. Primary Buyback Results: Bids Increases with m³ & Weighted by DAS | Reduce Capacity to 158,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$361,625,170
Total Annual Loan Payment ($)	$42,476,357
Annual Average Loan Payment ($) per Active Vessel	$257,432
Annual Average Loan Payment ($) per m³ of Remaining Fleet	$271.18
Loan Payment Fee as Percent of Future Total Revenue (%)	5.19%
Number of Vessels Bought Out	106
Number of Active Vessels Remaining: 67 Latent Vessels Remain	165
Capacity Removed (m³)	127,167
Capacity Remaining (m³)	156,638
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$170,786
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$226,847
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$82,170

Table B-78. Detailed Buyback Results: Bids Increases with m³ & Weighted by DAS | Reduce Capacity to 158,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m³)	156,638	283,805	-127,167
Total Cost of Buyback	$361,625,170	$0	$361,625,170
Number of Vessels Remaining (Active + Latent)	165	271	-106
Buyback Cost per Vessel Removed	$3,411,558	$0	$3,411,558
Buyback Cost per Remaining Active Vessel	$1,333,548	0	$1,333,548
Average Capacity of Vessels Selling (m³)	1,200	0	1,200
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	96.5%	100.0%	-3.5%
YFT Harvested by Remaining Fleet as a % of SQ	83.3%	100.0%	-16.7%
SKJ Harvested by Remaining Fleet as a % of SQ	98.0%	100.0%	-2.0%
Additional Revenue/Remaining Active Vessels from BET	$87,294	$0	$87,294
Additional Revenue/Remaining Active Vessels from YFT	$331,669	$0	$331,669
Additional Revenue/Remaining Active Vessels from SKJ	$408,191	$0	$408,191
Total Additional Revenue/Remaining Active Vessels	$827,154	$0	$827,154

Estimated Total Fleet Revenue per Year	$818,901,453	$937,723,098	($118,821,645)
Average Revenue/Active Vessel Remaining in the Fleet	$4,963,039	$4,135,885	$827,154
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,487,309	$1,059,090	$428,219
Net Operating Revenue/Active Vessel as a % of SQ	140%	100%	40%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-2	24	-26
Profitable Vessels in the Remaining Active Fleet	167	219	-52
Vessels Assumed to Sell Out at the Minimum Bid	76	0	76
FAD Vessels in the Remaining Active Fleet	117	157	-40
Dolphin Vessels in the Remaining Active Fleet	48	86	-38
Remaining Active Vessels: FAD Vessel Countries	105	143	-38
Remaining Active Vessels: Dolphin Vessel Countries	34	66	-32
Remaining Active Vessels: Mixed Vessel Countries	26	34	-8

Table B-79. Primary Buyback Results: Bids Increases with m³ & Weighted by DAS | Reduce Capacity to Eliminate Closure

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$327,686,578
Total Annual Loan Payment ($)	$38,489,943
Annual Average Loan Payment ($) per Active Vessel	$229,107
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$236.36
Loan Payment Fee as Percent of Future Total Revenue (%)	4.60%
Number of Vessels Bought Out	103
Number of Active Vessels Remaining: 67 Latent Vessels Remain	168
Capacity Removed (m^3)	120,963
Capacity Remaining (m^3)	162,842
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$194,444
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$253,338
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$110,496

Table B-80. Detailed Buyback Results: Bids Increases with m³ & Weighted by DAS | Reduce Capacity to Eliminate Closure

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	162,842	283,805	-120,963
Total Cost of Buyback	$327,686,578	$0	$327,686,578
Number of Vessels Remaining (Active + Latent)	168	271	-103
Buyback Cost per Vessel Removed	$3,181,423	$0	$3,181,423
Buyback Cost per Remaining Active Vessel	$1,386,366	0	$1,386,366
Average Capacity of Vessels Selling (m^3)	1,174	0	1,174
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	101.0%	100.0%	1.0%
YFT Harvested by Remaining Fleet as a % of SQ	83.9%	100.0%	-16.1%
SKJ Harvested by Remaining Fleet as a % of SQ	101.1%	100.0%	1.1%
Additional Revenue/Remaining Active Vessels from BET	$88,362	$0	$88,362
Additional Revenue/Remaining Active Vessels from YFT	$327,717	$0	$327,717

Additional Revenue/Remaining Active Vessels from SKJ	$411,608	$0	$411,608
Total Additional Revenue/Remaining Active Vessels	$827,687	$0	$827,687
Estimated Total Fleet Revenue per Year	$837,632,474	$937,723,098	($100,090,624)
Average Revenue/Active Vessel Remaining in the Fleet	$4,985,908	$4,158,221	$827,687
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,482,640	$1,059,090	$423,550
Net Operating Revenue/Active Vessel as a % of SQ	140%	100%	40%
Latent Vessels in the Remaining Fleet	0	28	-28
Unprofitable Vessels in the Remaining Active Fleet	-2	24	-26
Profitable Vessels in the Remaining Active Fleet	170	219	-49
Vessels Assumed to Sell Out at the Minimum Bid	76	0	76
FAD Vessels in the Remaining Active Fleet	120	157	-37
Dolphin Vessels in the Remaining Active Fleet	48	86	-38
Remaining Active Vessels: FAD Vessel Countries	107	143	-36
Remaining Active Vessels: Dolphin Vessel Countries	34	66	-32
Remaining Active Vessels: Mixed Vessel Countries	27	34	-7

Buyback Results under Scenario 6

Table B-81. Primary Buyback Results: Bids Increases with m^3 & Inversely Weighted | Reduce by 20,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$47,632,136
Total Annual Loan Payment ($)	$5,594,853
Annual Average Loan Payment ($) per Active Vessel	$21,770
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$21.30
Loan Payment Fee as Percent of Future Total Revenue (%)	0.64%
Number of Vessels Bought Out	14
Number of Active Vessels Remaining: 67 Latent Vessels Remain	257
Capacity Removed (m^3)	21,166
Capacity Remaining (m^3)	262,639
Estimated Closure Days After the Buyback	50
Average NOR Gain per Vessel less Average Buyback Loan Payment	$34,294
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$53,659
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$21,833

Table B-82. Detailed Buyback Results: Bids Increases with m^3 & Inversely Weighted | Reduce by 20,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	262,639	283,805	-21,166
Total Cost of Buyback	$47,632,136	$0	$47,632,136
Number of Vessels Remaining (Active + Latent)	257	271	-14
Buyback Cost per Vessel Removed	$3,402,295	$0	$3,402,295
Buyback Cost per Remaining Active Vessel	$2,235,994	0	$2,235,994
Average Capacity of Vessels Selling (m^3)	1,512	0	1,512
Estimated Closure Days After the Buyback	50	62	-12
BET Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%

YFT Harvested by Remaining Fleet as a % of SQ	92.8%	100.0%	-7.2%
SKJ Harvested by Remaining Fleet as a % of SQ	99.8%	100.0%	-0.2%
Additional Revenue/Remaining Active Vessels from BET	$12,704	$0	$12,704
Additional Revenue/Remaining Active Vessels from YFT	$51,185	$0	$51,185
Additional Revenue/Remaining Active Vessels from SKJ	$58,221	$0	$58,221
Total Additional Revenue/Remaining Active Vessels	$122,110	$0	$122,110
Estimated Total Fleet Revenue per Year	$875,465,096	$937,723,098	($62,258,002)
Average Revenue/Active Vessel Remaining in the Fleet	$3,406,479	$3,284,369	$122,110
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	104%	100%	4%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,115,154	$1,059,090	$56,064
Net Operating Revenue/Active Vessel as a % of SQ	105%	100%	5%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	20	24	-4
Profitable Vessels in the Remaining Active Fleet	209	219	-10
Vessels Assumed to Sell Out at the Minimum Bid	13	0	13
FAD Vessels in the Remaining Active Fleet	155	157	-2
Dolphin Vessels in the Remaining Active Fleet	74	86	-12
Remaining Active Vessels: FAD Vessel Countries	141	143	-2
Remaining Active Vessels: Dolphin Vessel Countries	58	66	-8
Remaining Active Vessels: Mixed Vessel Countries	30	34	-4

Table B-83. Primary Buyback Results: Bids Increases with m³ & Inversely Weighted | Reduce by 40,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$92,408,240
Total Annual Loan Payment ($)	$10,854,237
Annual Average Loan Payment ($) per Active Vessel	$44,668
Annual Average Loan Payment ($) per m³ of Remaining Fleet	$44.54
Loan Payment Fee as Percent of Future Total Revenue (%)	1.24%
Number of Vessels Bought Out	28
Number of Active Vessels Remaining: 67 Latent Vessels Remain	243
Capacity Removed (m³)	40,111
Capacity Remaining (m³)	243,694
Estimated Closure Days After the Buyback	30
Average NOR Gain per Vessel less Average Buyback Loan Payment	$119,778
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$169,393
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$99,029

Table B-84. Detailed Buyback Results: Bids Increases with m³ & Inversely Weighted | Reduce by 40,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m³)	243,694	283,805	-40,111
Total Cost of Buyback	$92,408,240	$0	$92,408,240
Number of Vessels Remaining (Active + Latent)	243	271	-28
Buyback Cost per Vessel Removed	$3,300,294	$0	$3,300,294
Buyback Cost per Remaining Active Vessel	$2,074,704	0	$2,074,704
Average Capacity of Vessels Selling (m³)	1,433	0	1,433

Estimated Closure Days After the Buyback	30	62	-32
BET Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
YFT Harvested by Remaining Fleet as a % of SQ	89.1%	100.0%	-10.9%
SKJ Harvested by Remaining Fleet as a % of SQ	103.2%	100.0%	3.2%
Additional Revenue/Remaining Active Vessels from BET	$35,064	$0	$35,064
Additional Revenue/Remaining Active Vessels from YFT	$135,245	$0	$135,245
Additional Revenue/Remaining Active Vessels from SKJ	$166,038	$0	$166,038
Total Additional Revenue/Remaining Active Vessels	$336,347	$0	$336,347
Estimated Total Fleet Revenue per Year	$871,900,321	$937,723,098	($65,822,777)
Average Revenue/Active Vessel Remaining in the Fleet	$3,588,067	$3,251,720	$336,347
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	110%	100%	10%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,223,535	$1,059,090	$164,446
Net Operating Revenue/Active Vessel as a % of SQ	116%	100%	16%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	13	24	-11
Profitable Vessels in the Remaining Active Fleet	202	219	-17
Vessels Assumed to Sell Out at the Minimum Bid	23	0	23
FAD Vessels in the Remaining Active Fleet	151	157	-6
Dolphin Vessels in the Remaining Active Fleet	64	86	-22
Remaining Active Vessels: FAD Vessel Countries	138	143	-5
Remaining Active Vessels: Dolphin Vessel Countries	49	66	-17
Remaining Active Vessels: Mixed Vessel Countries	28	34	-6

Table B-85. Primary Buyback Results: Bids Increases with m^3 & Inversely Weighted | Reduce by 60,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$149,051,509
Total Annual Loan Payment ($)	$17,507,534
Annual Average Loan Payment ($) per Active Vessel	$76,452
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$78.52
Loan Payment Fee as Percent of Future Total Revenue (%)	2.00%
Number of Vessels Bought Out	42
Number of Active Vessels Remaining: 67 Latent Vessels Remain	229
Capacity Removed (m^3)	60,841
Capacity Remaining (m^3)	222,964
Estimated Closure Days After the Buyback	3
Average NOR Gain per Vessel less Average Buyback Loan Payment	$235,314
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$316,334
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$218,857

Table B-86. Detailed Buyback Results: Bids Increases with m^3 & Inversely Weighted | Reduce Capacity by 60,000 m^3

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	222,964	283,805	-60,841
Total Cost of Buyback	$149,051,509	$0	$149,051,509
Number of Vessels Remaining (Active + Latent)	229	271	-42
Buyback Cost per Vessel Removed	$3,548,845	$0	$3,548,845

Buyback Cost per Remaining Active Vessel	$1,898,218	0	$1,898,218
Average Capacity of Vessels Selling (m^3)	1,449	0	1,449
Estimated Closure Days After the Buyback	3	62	-59
BET Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
YFT Harvested by Remaining Fleet as a % of SQ	87.7%	100.0%	-12.3%
SKJ Harvested by Remaining Fleet as a % of SQ	105.6%	100.0%	5.6%
Additional Revenue/Remaining Active Vessels from BET	$62,811	$0	$62,811
Additional Revenue/Remaining Active Vessels from YFT	$240,217	$0	$240,217
Additional Revenue/Remaining Active Vessels from SKJ	$304,726	$0	$304,726
Total Additional Revenue/Remaining Active Vessels	$607,754	$0	$607,754
Estimated Total Fleet Revenue per Year	$875,326,066	$937,723,098	($62,397,031)
Average Revenue/Active Vessel Remaining in the Fleet	$3,822,385	$3,214,631	$607,754
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	119%	100%	19%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,370,855	$1,059,090	$311,766
Net Operating Revenue/Active Vessel as a % of SQ	129%	100%	29%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	9	24	-15
Profitable Vessels in the Remaining Active Fleet	192	219	-27
Vessels Assumed to Sell Out at the Minimum Bid	28	0	28
FAD Vessels in the Remaining Active Fleet	146	157	-11
Dolphin Vessels in the Remaining Active Fleet	55	86	-31
Remaining Active Vessels: FAD Vessel Countries	134	143	-9
Remaining Active Vessels: Dolphin Vessel Countries	42	66	-24
Remaining Active Vessels: Mixed Vessel Countries	25	34	-9

Table B-87. Primary Buyback Results: Bids Increases with m³ & Inversely Weighted | Reduce by 80,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$215,258,859
Total Annual Loan Payment ($)	$25,284,225
Annual Average Loan Payment ($) per Active Vessel	$117,601
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$124.23
Loan Payment Fee as Percent of Future Total Revenue (%)	3.09%
Number of Vessels Bought Out	56
Number of Active Vessels Remaining: 67 Latent Vessels Remain	215
Capacity Removed (m^3)	80,281
Capacity Remaining (m^3)	203,524
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$218,888
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$304,518
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$224,036

Table B-88. Detailed Buyback Results: Bids Increases with m³ & Inversely Weighted | Reduce by 80,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	203,524	283,805	-80,281
Total Cost of Buyback	$215,258,859	$0	$215,258,859

Number of Vessels Remaining (Active + Latent)	215	271	-56
Buyback Cost per Vessel Removed	$3,843,908	$0	$3,843,908
Buyback Cost per Remaining Active Vessel	$1,732,715	0	$1,732,715
Average Capacity of Vessels Selling (m^3)	1,434	0	1,434
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	96.3%	100.0%	-3.7%
YFT Harvested by Remaining Fleet as a % of SQ	78.5%	100.0%	-21.5%
SKJ Harvested by Remaining Fleet as a % of SQ	101.6%	100.0%	1.6%
Additional Revenue/Remaining Active Vessels from BET	$66,984	$0	$66,984
Additional Revenue/Remaining Active Vessels from YFT	$238,145	$0	$238,145
Additional Revenue/Remaining Active Vessels from SKJ	$324,831	$0	$324,831
Total Additional Revenue/Remaining Active Vessels	$629,960	$0	$629,960
Estimated Total Fleet Revenue per Year	$818,324,211	$937,723,098	($119,398,886)
Average Revenue/Active Vessel Remaining in the Fleet	$3,806,159	$3,176,199	$629,960
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,395,579	$1,059,090	$336,489
Net Operating Revenue/Active Vessel as a % of SQ	132%	100%	32%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	5	24	-19
Profitable Vessels in the Remaining Active Fleet	182	219	-37
Vessels Assumed to Sell Out at the Minimum Bid	34	0	34
FAD Vessels in the Remaining Active Fleet	142	157	-15
Dolphin Vessels in the Remaining Active Fleet	45	86	-41
Remaining Active Vessels: FAD Vessel Countries	130	143	-13
Remaining Active Vessels: Dolphin Vessel Countries	37	66	-29
Remaining Active Vessels: Mixed Vessel Countries	20	34	-14

Table B-89. Primary Buyback Results: Bids Increases with m^3 & Inversely Weighted | Reduce by 100,000 m^3

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$326,731,125
Total Annual Loan Payment ($)	$38,377,715
Annual Average Loan Payment ($) per Active Vessel	$194,811
Annual Average Loan Payment ($) per m^3 of Remaining Fleet	$209.61
Loan Payment Fee as Percent of Future Total Revenue (%)	5.27%
Number of Vessels Bought Out	74
Number of Active Vessels Remaining: 67 Latent Vessels Remain	197
Capacity Removed (m^3)	100,715
Capacity Remaining (m^3)	183,090
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$148,850
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$237,877
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$156,429

Table B-90. Detailed Buyback Results: Bids Increases with m^3 & Inversely Weighted | Reduce by 100,000 m^3

Measure	Scenario	Status Quo (SQ)	Change

Vessel Capacity (m³)	183,090	283,805	-100,715
Total Cost of Buyback	$326,731,125	$0	$326,731,125
Number of Vessels Remaining (Active + Latent)	197	271	-74
Buyback Cost per Vessel Removed	$4,415,285	$0	$4,415,285
Buyback Cost per Remaining Active Vessel	$1,558,748	0	$1,558,748
Average Capacity of Vessels Selling (m³)	1,361	0	1,361
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	88.8%	100.0%	-11.2%
YFT Harvested by Remaining Fleet as a % of SQ	64.9%	100.0%	-35.1%
SKJ Harvested by Remaining Fleet as a % of SQ	94.2%	100.0%	-5.8%
Additional Revenue/Remaining Active Vessels from BET	$67,565	$0	$67,565
Additional Revenue/Remaining Active Vessels from YFT	$214,485	$0	$214,485
Additional Revenue/Remaining Active Vessels from SKJ	$329,888	$0	$329,888
Total Additional Revenue/Remaining Active Vessels	$611,937	$0	$611,937
Estimated Total Fleet Revenue per Year	$728,252,700	$937,723,098	($209,470,398)
Average Revenue/Active Vessel Remaining in the Fleet	$3,696,714	$3,084,777	$611,937
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,402,751	$1,059,090	$343,661
Net Operating Revenue/Active Vessel as a % of SQ	132%	100%	32%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	4	24	-20
Profitable Vessels in the Remaining Active Fleet	165	219	-54
Vessels Assumed to Sell Out at the Minimum Bid	37	0	37
FAD Vessels in the Remaining Active Fleet	133	157	-24
Dolphin Vessels in the Remaining Active Fleet	36	86	-50
Remaining Active Vessels: FAD Vessel Countries	124	143	-19
Remaining Active Vessels: Dolphin Vessel Countries	29	66	-37
Remaining Active Vessels: Mixed Vessel Countries	16	34	-18

Table B-91. Primary Buyback Results: Bids Increases with m³ & Inversely Weighted | Reduce to 171,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$391,912,664
Total Annual Loan Payment ($)	$46,033,914
Annual Average Loan Payment ($) per Active Vessel	$244,861
Annual Average Loan Payment ($) per m³ of Remaining Fleet	$270.51
Loan Payment Fee as Percent of Future Total Revenue (%)	6.71%
Number of Vessels Bought Out	83
Number of Active Vessels Remaining: 67 Latent Vessels Remain	188
Capacity Removed (m³)	113,628
Capacity Remaining (m³)	170,177
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$99,946
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$192,394
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$127,295

Table B-92. Detailed Buyback Results: Bids Increases with m³ & Inversely Weighted | Reduce to 171,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m³)	170,177	283,805	-113,628
Total Cost of Buyback	$391,912,664	$0	$391,912,664
Number of Vessels Remaining (Active + Latent)	188	271	-83
Buyback Cost per Vessel Removed	$4,721,839	$0	$4,721,839
Buyback Cost per Remaining Active Vessel	$1,448,813	0	$1,448,813
Average Capacity of Vessels Selling (m³)	1,369	0	1,369
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	85.8%	100.0%	-14.2%
YFT Harvested by Remaining Fleet as a % of SQ	58.4%	100.0%	-41.6%
SKJ Harvested by Remaining Fleet as a % of SQ	90.6%	100.0%	-9.4%
Additional Revenue/Remaining Active Vessels from BET	$67,497	$0	$67,497
Additional Revenue/Remaining Active Vessels from YFT	$204,177	$0	$204,177
Additional Revenue/Remaining Active Vessels from SKJ	$328,331	$0	$328,331
Total Additional Revenue/Remaining Active Vessels	$600,005	$0	$600,005
Estimated Total Fleet Revenue per Year	$685,659,383	$937,723,098	($252,063,715)
Average Revenue/Active Vessel Remaining in the Fleet	$3,647,124	$3,047,119	$600,005
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,403,897	$1,059,090	$344,808
Net Operating Revenue/Active Vessel as a % of SQ	133%	100%	33%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	3	24	-21
Profitable Vessels in the Remaining Active Fleet	157	219	-62
Vessels Assumed to Sell Out at the Minimum Bid	39	0	39
FAD Vessels in the Remaining Active Fleet	129	157	-28
Dolphin Vessels in the Remaining Active Fleet	31	86	-55
Remaining Active Vessels: FAD Vessel Countries	120	143	-23
Remaining Active Vessels: Dolphin Vessel Countries	25	66	-41
Remaining Active Vessels: Mixed Vessel Countries	15	34	-19

Table B-93. Primary Buyback Results: Bids Increases with m³ & Inversely Weighted | Reduce to 158,000 m³

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$484,333,544
Total Annual Loan Payment ($)	$56,889,636
Annual Average Loan Payment ($) per Active Vessel	$319,605
Annual Average Loan Payment ($) per m³ of Remaining Fleet	$362.15
Loan Payment Fee as Percent of Future Total Revenue (%)	8.92%
Number of Vessels Bought Out	93
Number of Active Vessels Remaining: 67 Latent Vessels Remain	178
Capacity Removed (m³)	126,718
Capacity Remaining (m³)	157,087
Estimated Closure Days After the Buyback	No Closure
Average NOR Gain per Vessel less Average Buyback Loan Payment	$27,645
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$116,605

Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$75,956

Table B-94. Detailed Buyback Results: Bids Increases with m³ & Inversely Weighted | Reduce to 158,000 m³

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m³)	157,087	283,805	-126,718
Total Cost of Buyback	$484,333,544	$0	$484,333,544
Number of Vessels Remaining (Active + Latent)	178	271	-93
Buyback Cost per Vessel Removed	$5,207,888	$0	$5,207,888
Buyback Cost per Remaining Active Vessel	$1,337,370	0	$1,337,370
Average Capacity of Vessels Selling (m³)	1,363	0	1,363
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	79.8%	100.0%	-20.2%
YFT Harvested by Remaining Fleet as a % of SQ	53.8%	100.0%	-46.2%
SKJ Harvested by Remaining Fleet as a % of SQ	84.5%	100.0%	-15.5%
Additional Revenue/Remaining Active Vessels from BET	$67,521	$0	$67,521
Additional Revenue/Remaining Active Vessels from YFT	$195,961	$0	$195,961
Additional Revenue/Remaining Active Vessels from SKJ	$327,192	$0	$327,192
Total Additional Revenue/Remaining Active Vessels	$590,674	$0	$590,674
Estimated Total Fleet Revenue per Year	$637,608,289	$937,723,098	($300,114,808)
Average Revenue/Active Vessel Remaining in the Fleet	$3,582,069	$2,991,395	$590,674
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,406,339	$1,059,090	$347,250
Net Operating Revenue/Active Vessel as a % of SQ	133%	100%	33%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	3	24	-21
Profitable Vessels in the Remaining Active Fleet	147	219	-72
Vessels Assumed to Sell Out at the Minimum Bid	40	0	40
FAD Vessels in the Remaining Active Fleet	123	157	-34
Dolphin Vessels in the Remaining Active Fleet	27	86	-59
Remaining Active Vessels: FAD Vessel Countries	114	143	-29
Remaining Active Vessels: Dolphin Vessel Countries	22	66	-44
Remaining Active Vessels: Mixed Vessel Countries	14	34	-20

Table B-95. Primary Buyback Results: Bids Increases with m³ & Inversely Weighted | Reduce to Eliminate Closure

Total Cost of the Buyback = Total Loan Amount ($) (Assumes Grant = $0)	$161,909,149
Total Annual Loan Payment ($)	$19,017,788
Annual Average Loan Payment ($) per Active Vessel	$84,524
Annual Average Loan Payment ($) per m³ of Remaining Fleet	$87.54
Loan Payment Fee as Percent of Future Total Revenue (%)	2.19%
Number of Vessels Bought Out	46
Number of Active Vessels Remaining: 67 Latent Vessels Remain	225
Capacity Removed (m³)	66,547
Capacity Remaining (m³)	217,258
Estimated Closure Days After the Buyback	No Closure

Average NOR Gain per Vessel less Average Buyback Loan Payment	$245,606
Average FAD Vessel NOR Gain less Average. Buyback Loan Payment	$331,423
Average Dolphin Vessel NOR Gain less Average Buyback Loan Payment	$242,256

Table B-96. Detailed Buyback Results: Bids Increases with m^3 & Inversely Weighted | Reduce to Eliminate Closure

Measure	Scenario	Status Quo (SQ)	Change
Vessel Capacity (m^3)	217,258	283,805	-66,547
Total Cost of Buyback	$161,909,149	$0	$161,909,149
Number of Vessels Remaining (Active + Latent)	225	271	-46
Buyback Cost per Vessel Removed	$3,519,764	$0	$3,519,764
Buyback Cost per Remaining Active Vessel	$1,849,640	0	$1,849,640
Average Capacity of Vessels Selling (m^3)	1,447	0	1,447
Estimated Closure Days After the Buyback	No Closure	62	-62
BET Harvested by Remaining Fleet as a % of SQ	100.0%	100.0%	0.0%
YFT Harvested by Remaining Fleet as a % of SQ	85.9%	100.0%	-14.1%
SKJ Harvested by Remaining Fleet as a % of SQ	105.5%	100.0%	5.5%
Additional Revenue/Remaining Active Vessels from BET	$66,217	$0	$66,217
Additional Revenue/Remaining Active Vessels from YFT	$249,594	$0	$249,594
Additional Revenue/Remaining Active Vessels from SKJ	$322,225	$0	$322,225
Total Additional Revenue/Remaining Active Vessels	$638,035	$0	$638,035
Estimated Total Fleet Revenue per Year	$866,420,881	$937,723,098	($71,302,217)
Average Revenue/Active Vessel Remaining in the Fleet	$3,850,759	$3,212,724	$638,035
Note: The value shown for SQ is the unadjusted mean revenue/remaining active vessel from 2014–2016 after the buyback. Revenue/active vessel under the SQ was $3.9 million; if latent vessels are included, SQ revenue/vessel was $3.6 million.			
Revenue/Remaining Active Vessel as a Percent of SQ	120%	100%	20%
Avg. Net Operating Revenue/Remaining Active Vessel	$1,389,219	$1,059,090	$330,129
Net Operating Revenue/Active Vessel as a % of SQ	131%	100%	31%
Latent Vessels in the Remaining Fleet	28	28	0
Unprofitable Vessels in the Remaining Active Fleet	7	24	-17
Profitable Vessels in the Remaining Active Fleet	190	219	-29
Vessels Assumed to Sell Out at the Minimum Bid	31	0	31
FAD Vessels in the Remaining Active Fleet	145	157	-12
Dolphin Vessels in the Remaining Active Fleet	52	86	-34
Remaining Active Vessels: FAD Vessel Countries	133	143	-10
Remaining Active Vessels: Dolphin Vessel Countries	39	66	-27
Remaining Active Vessels: Mixed Vessel Countries	25	34	-9