Discussion Paper

Estimating the use of drifting Fish Aggregation Devices (FADs) around the globe

Adam Baske

James Gibbon

Joanna Benn

Amanda Nickson

THE PEW ENVIRONMENT GROUP

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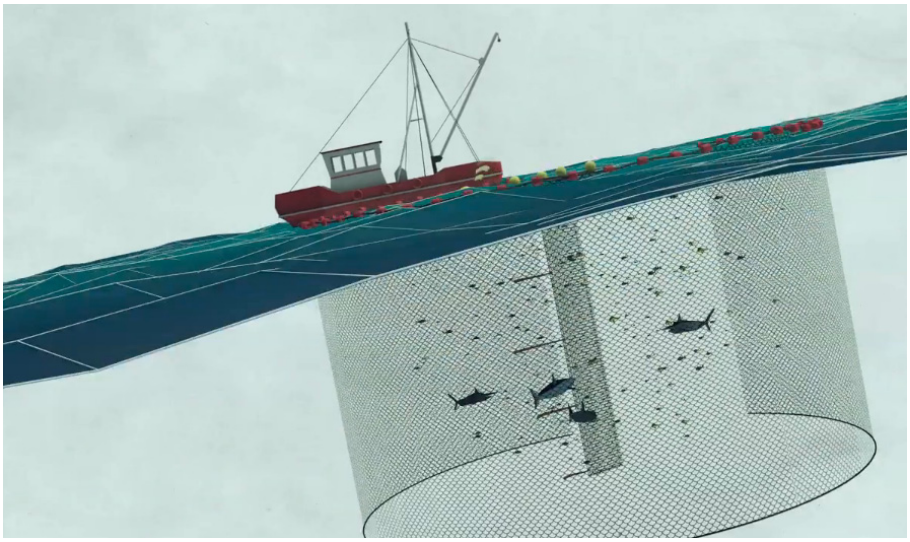

Purse seine vessel deploying a FAD at sea.

Purse seine net being drawn in around FAD at sea capturing tuna and other species.

Foreword

To date, there are no publically available estimates of the number of drifting fish aggregating devices (FADs) deployed by industrial tuna fisheries. Despite the ecological consequences of unmanaged FAD use, no transparent systems are in place to regulate the deployment and tracking of this gear, which catches almost one-half of the world's tuna.

The Pew Environment Group took on the task of developing a 'back of the envelope' estimate of how many drifting FADs are currently in use, while acknowledging that it would be a challenging exercise and the results both imperfect and preliminary. Collating data gathered using three separate methodologies, we were able to conclude that the number of drifting FADs put into the oceans each year ranges from 47,000–105,000. While much of the data needed in order to develop a more accurate estimate exist, they are currently considered proprietary by the fishing industry and thus confidential. As a result, some of the information used to estimate the extent of FAD use was obtained through informal conversations and industry consultants.

Although these estimates are imperfect, what is clear is that even the lowest end of the range, at 47,000 FADs per year, is a stark indicator that greater transparency and regulation of this fishing gear are essential. This is even more compelling when one considers that this estimate does not include drifting FADs already in the ocean, as some can last for several years.

Our aim in undertaking this analysis was to initiate a conversation with all stakeholders about the scale of use of drifting FADs and the need to better monitor and regulate this fishing gear. With more and improved data our understanding of the true extent of fishing effort can grow, science and stock assessment improve, and, ultimately, decision makers can adopt more sustainable management measures. This better understanding will also help in the clamp down on illegal fishing and illicit practices.

The bottom line is that whether there are 47,000, 105,000, or even more FADs deployed each year, they can no longer be willingly ignored. FAD use affects ecosystems, including associated and dependent species, adds to marine debris, and has already played a role in driving two populations of bigeye tuna into the 'overfishing' category.

The Pew Environment Group has conducted this first estimate, but it is now up to industry, RFMOs and other stakeholders to provide the full picture on FAD deployment by stepping up and sharing their information. If the multi-billion-dollar global tuna industry is serious about sustainable fisheries management for the long term, it must work with all interested sectors on the regulation and management of FADs.

Amanda Nickson, Director, Global Tuna Campaign. The Pew Environment Group

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Introduction and Executive Summary

Between 47,000 and 105,000 fish aggregating devices (FADs) are let loose in our oceans each year.

Many fish species naturally associate with objects floating in the ocean, a fact that has been carefully and systematically exploited to catch schools of commercially valuable tuna for decades. FADs are human-made floating objects specifically constructed to attract these fish.

The purse seine industry's increasing dependence on drifting FADs is an emerging issue that must be urgently addressed. While observed FAD deployments have increased by more than 60 percent since 2006 in the eastern Pacific Ocean alone, the proliferation in FAD use continues to be largely unchecked. Currently, there are no regulations requiring fishermen or vessel owners to record or report the number of FADs in use, although some RFMOs (Regional Fisheries Management Organizations) have measures in place that aim to improve the monitoring of drifting FADs.

FADs are closely linked to issues of long-term sustainability. Across the entire Pacific Ocean, bigeye tuna are being overfished – a trend driven by the increased use of FADs, which tend to attract juvenile bigeye. Alarmingly, the total tonnage of bigeye tuna caught on FADs (77,095 metric tonnes) in the western and central Pacific last year exceeded the amount caught by the longline fishery (67,699 metric tonnes)[1]. Considering juvenile bigeye are caught on FADs, the impacts of this on the overall sustainability of the fishery are of great concern. The use of FADs also has serious implications for threatened shark species, including silky and oceanic whitetip sharks, which are caught as bycatch.

There is increasing recognition of the urgent need for FAD management. At an international FAD symposium held in 2011, scientists and fisheries managers from around the world agreed that the proliferation of drifting FADs has resulted in negative impacts on tunas and other bycatch species. They called on countries and RFMOs to take a number of steps to fill this data-gap; namely these were to:

- share basic technical data on: 1) the numbers of drifting FADs deployed; 2) the number of drifting FADs actively monitored by fishing vessels and companies; and 3) the movement and range of drifting FADs throughout an ocean area;
- develop FAD management plans to record the number and fate (lost, stolen, retrieved) of deployed FADs, and outline identification procedures to clarify ownership of and responsibility for lost or abandoned gear.

Building on the efforts of scientists and some fishery managers to acknowledge and address the problem, the Pew Environment Group conducted the first-ever study to establish a global estimate of annual FAD deployment. This was developed using three separate methods, which yielded an estimate of **between 47,000 and 105,000 drifting FADs being deployed each year.** While none of the methods are perfect, they do demonstrate the magnitude of the usage of FADs as well as their potential contribution to the problem of marine debris.

In conducting this survey, we experienced great difficulty in obtaining the information required to derive more accurate estimates. This struggle points to the need for clear and transparent regulation and management of this fishing gear by managers, governments, and RFMOs.

A number of positive initiatives are underway, and these should be built upon across all tuna fisheries. The International Commission for the Conservation of Atlantic Tunas (ICCAT) adopted a measure in 2011 requiring vessels to record all FAD deployments and develop FAD management plans. The Inter-American Tropical Tuna Commission (IATTC) already records all FAD deployments and retrievals for large purse seine vessels. The Parties to the Nauru Agreement (PNA), a group of eight Pacific island States that have the largest skipjack fishery in their waters, is developing a FAD tracking system. This will allow them to monitor FAD numbers and locations in near real-time so they can better understand the impact of drifting FADs on this hugely important fishery.

Although these are all steps in the right direction, the first major step must be to put effective regulatory requirements in place to ensure that the next global estimate of FADs is based on transparent and accurate data. **To this end, the Pew Environment Group calls on tuna RFMOs and the Food and Agriculture Organization of the UN (FAO) to undertake an independent review of drifting FAD use**, in order to produce a more accurate estimate of the extent of use than it has been possible to make with the information that is currently available.

[1] Williams, P. and P. Terawasi. 2012. Overview of tuna fisheries in the Western and Central Pacific Ocean, including economic conditions – 2011. http://www.wcpfc.int/node/5408

Methodology: How the Pew Environment Group came up with the Estimates

Since there is no verifiable information on the numbers of FADs being deployed and/or monitored by the tropical tuna purse seine fleets in the Atlantic, Pacific and Indian Oceans, we set out to estimate a figure using three distinct methods.

1. The first approach analysed publically available scientific studies and RFMO reports in order to estimate FAD deployments in the major tuna fisheries. This resulted in an estimate of 61,900 FADs deployed per year, but for a number of reasons (see p. 4) we feel this is an underestimate.
2. The second methodology involved outreach to the manufacturers of satellite-tracked buoys, as most drifting FADs currently in use are outfitted with this technology and only a limited number of companies produce them. Given the information we were able to obtain, we arrived at an estimate of 47,000 to 70,000 buoys being produced each year by these companies. This estimate is also preliminary, as not all drifting FADs are outfitted with these devices, and perhaps not all manufactured buoys are deployed each year.
3. A final approach estimated annual FAD use by combining the reported number of tropical tuna purse seine vessels with information on drifting FAD usage gained from industry experts and informal discussions with stakeholders in the tuna purse seine industry between August 2011 and October 2012. Given that we could not get information on every fleet or vessel, our methodology required a number of assumptions and extrapolations. This resulted in an estimate of approximately 105,000 drifting FADs.

Method #1: Published scientific and RFMO literature

In order to estimate the number of drifting FADs deployed in each of the major tuna fishing zones each year, with the first method, we looked at existing literature published by the scientific community as well as documents submitted to tuna RFMOs.

Eastern Pacific Ocean

The IATTC is the only tuna RFMO that gathers information from observers relating to the number of drifting FAD deployments. The number of FAD deployments by vessels larger than 363 gross tonnes was 12,864 in 2011. This shows a 61 percent increase in annual FAD deployments since 2006.

	2006	2007	2008	2009	2010	2011
Drifting FADs deployed in the eastern Pacific Ocean	8,006	8,403	9,724	10,768	11,090	12,864

It is important to note that these data only reflect 'observed' deployments. There are many purse seine vessels in the eastern Pacific Ocean that are not required to carry observers, so these figures must be considered an underestimate. Ecuador, for example, has 42 purse seine vessels that are not required to carry observers, and many of these fish on FADs.

In 2011, large purse seiners with observers set their nets around FADs 6,920 times[2]. According to IATTC data, 12,864 FADs were deployed by these vessels in the same time period. Smaller vessels do not carry observers. However, if they exhibit a similar FAD Set to FAD Deployment ratio as large vessels, it is possible to estimate the number of FADs deployed by these smaller purse seiners. The smaller vessels set their nets around FADs 2,269 times, therefore:

FAD Deployment to FAD Set ratio for large vessels in 2011: 12,864 deployments / 6,920 sets = 1.856 ratio

2,269 FAD sets by smaller vessels in 2011 x 1.856 = 4,218 FAD deployments

Based on this calculation, the total estimated number of FADs deployed each year in the eastern Pacific Ocean, derived from reported FAD deployments and the known ratio of deployments to FAD sets, amounts to 17,082 drifting FADs.

Indian Ocean

A study submitted to the Indian Ocean Tuna Commission (IOTC) in 2010 provides limited information on the use of FADs in the Indian Ocean[3]. This report analysed data from purse seine supply vessels – boats that deploy FADs, check FADs for tuna, repair FADs, and otherwise assist purse seine vessels in finding fish.

[2] Inter-American Tropical Tuna Commission. 2012. The Fishery for Tunas and Billfishes in the Eastern Pacific Ocean in 2011. DOCUMENT SAC-03-03. http://iattc.org/Meetings/Meetings2012/May/PDFs/SAC-03-03-The-fishery-in-the-EPO-2011.pdf

[3] Ramos, Mª L., A. Delgado de Molina and J. Ariz. 2010. Analysis of activity data obtained from supply vessels' logbooks implemented by the Spanish fleet and associated in Indian Ocean. IOTC-2010-WPTT-22

The report offers data from supply vessels that worked for about one-third of the IOTC purse seine fleet.

In this report we reviewed the number of satellite-tracked buoys these vessels registered during each year of the study. The most recent data show that these vessels registered about 3,800 FAD tracking buoys in 2009[4]. Given that these values pertained to only 14 purse seine vessels, it is safe to assume that the number of buoys deployed by the entire fleet was much larger. IOTC supply vessels can deploy up to 15 FADs a day, with the average for Spanish supply vessels being five per day.

Since 3,800 satellite-tracked buoys were registered in 2009 for one-third of the fleet, a conservative estimate is derived by doubling this number, which assumes that other fleets use fewer FADs than the Spanish vessels in the IOTC report. **Thus, a conservative estimate for the number of drifting FADs deployed in the Indian Ocean per year is 7,600.**

Western and Central Pacific Ocean

The Western and Central Pacific Fisheries Commission (WCPFC) manages the world's largest tuna purse seine fleet, which numbered 283 vessels in 2011[5]. There is no literature available documenting the total number of FADs deployed in the area, however, the Secretariat of the Pacific Community, the body responsible for providing stock assessments and collating observer data for the WCPFC, estimates that purse seiners operating in the region typically deploy 100 or more FADs with satellite transmitters, at a time[6]. **If all 283 vessels deployed 100 drifting FADs, then there would be an estimated 28,300 FADs deployed in the Western and Central Pacific Ocean.**

Atlantic Ocean

Literature on numbers of sets made on a FAD or the number of FADs retrieved, lost or appropriated each year is not available for the Atlantic Ocean. The largest purse seine fleets for tropical tunas in the Atlantic Ocean in terms of number of vessels, are those of France, Spain, and Ghana. In recent years, a number of vessels from the Indian Ocean are known to have moved over to the Atlantic Ocean to avoid piracy, so the number of purse seine vessels operating in this area has increased[7].

Information on the Ghanaian fleet suggests that it deployed more than 1,500 FADs in 2011[8] and, in the same year, ICCAT reported that over 90 percent of sets from purse seiners had been on FADs[9], suggesting that FADs are a critical gear for all fleets fishing in the area. According to the report of ICCAT's 2012 Inter-session Meeting of the Tropical Tuna Species Group, **the total number of drifting FADs in the Atlantic in 2010 was estimated to vary between about 2,500 and 9,000 by quarter**[10].

Estimated number of drifting FADs deployed per year by the tropical tuna purse seine fleet

RFMO	FADs deployed per year
IOTC	7,600
WCPFC	28,300
IATTC	17,000
ICCAT	9,000
TOTAL	**61,900**

Using this approximation, the figure of 61,900 drifting FADs deployed per year is likely to be a conservative estimate. Unfortunately, however, there is currently no way to confirm the total number of FADs being deployed and tracked at a given time without cooperation from the industry. Indeed, if a number of other issues are taken into consideration, that figure is probably an underestimate, including:

- All FAD deployments are not observed i.e. in the case of IATTC, observers are only carried on large purse seine vessels.
- Not all FADs are deployed by purse seine vessels. Baitboat vessels also regularly utilise and deploy FADs, but there is no information on the use of FADs by baitboats in any ocean area. Additionally, other vessels can, and do, deploy FADs in cooperation with purse seine vessels. Supply vessels are allowed to assist with FAD fishing activities in the Indian Ocean, and other vessel types (without observers), such as longliners, may work in cooperation with purse seine vessels in certain ocean areas.
- Not all FADs deployed are monitored. FADs are regularly lost or abandoned or drift out of the fishing area and must be replaced. If a report says that 20 FADs are monitored at a given time that does not mean that only 20 FADs are deployed.

[4] Ibid.

[5] Williams, P. and P. Terawasi. 2012. Overview of tuna fisheries in the Western and Central Pacific Ocean, including economic conditions – 2011.

[6] Hampton, J. 2010. Tuna fisheries status and management in the Western and Central Pacific Ocean. Secretariat of the Pacific Community, New Caledonia.

[7] Chassot, E. *et al.* Analysis of the effects of Somali piracy on the European tuna purse seine fisheries of the Indian Ocean. http://www.iotc.org/files/proceedings/2010/sc/IOTC-2010-SC-09.pdf

[8] ICCAT 2011 Annual Reports

[9] ICCAT

[10] http://www.iccat.int/Documents/Meetings/Docs/2012_TROP_REP_ENG.pdf

- FAD-use levels have not been constant over recent years. Based on IATTC data, FAD deployments are on the rise. Given that the FAD fishery is very dynamic, and technology is constantly changing, basing current estimates on historical data will likely yield underestimates.

Method #2: Information from the manufacturers of FAD tracking buoys

With the second method we estimated the number of satellite-tracked buoys manufactured each year by the five major buoy-producing companies[11]. **Information gathered by Pew staff and consultants on market share, recent production and recent increases in demand led to an estimated output of 47,500–70,000 buoys per year by these major manufacturers.** This number provides a rough estimate of the number of new drifting FADs placed in the water annually, given that the vast majority of FADs deployed have a satellite-tracked buoy attached.

This method assumes that the five companies represented in the estimate produce the large majority of tracking buoys used in the FAD fishery and that most buoys produced each year are then sold and placed on drifting FADs.

Method #3: Extrapolation based on vessel numbers and stakeholder information

In the third method, we arrived at an estimate by combining data on the number of purse seine vessels fishing in the four ocean areas with information obtained from stakeholders knowledgeable about drifting FAD use. Firstly, an estimate of the number of tuna purse seine vessels around the globe was produced from published RFMO vessel registries; this was then broken down by flag State and vessel size. Secondly, and based on informal conversations with industry, buoy companies, vessel operators and fleet managers, estimates of the numbers of drifting FADs used by each size class of vessel from each flag State were calculated and then added together to produce an estimate of the global number of drifting FADs currently in use.

The list of tropical tuna purse seine vessels worldwide was collated from the public data vessel registers of four of the tuna RMFOs (IATTC, ICCAT, IOTC and WCPFC). It was limited to vessels registered as 400 gross registered tonnes (GRT) or greater, as vessels that are less than 400 GRT are not likely to use drifting FADs in their typical operations. After consultation with the respective RFMO Secretariats to resolve overlapping entries and determine which vessels were currently active, a final list of 529 tuna purse seine vessels was produced. To facilitate the analysis the list was broken down into four size categories: smaller vessels, 400–799 GRT; medium vessels, 800–1,399 GRT; large vessels, 1,400–2,399 GRT; and extra-large vessels, greater than 2,400 GRT. This breakdown reflects both the current fleet size distribution and differences in operating practices.

From the conversations held with stakeholders, an estimate of the number of FADs used by several fleets across various vessel size classes was then calculated. When direct information was not available, estimates were extrapolated using data from fleets with similar characteristics. When possible, the information obtained was cross-checked with several different sources.

Combining these pieces of information on vessel numbers and FAD usage produced a total estimate of approximately 105,000 drifting FADs actively monitored by the world's tuna fishing fleet. It was also possible to determine which fleets deploy the most drifting FADs.

Top 8 users of drifting FADs in alphabetical order
Chinese Taipei
Ecuador
France
Japan
Philippines
South Korea
Spain
USA

Due to the limited amount of information available, it was necessary to make several assumptions when calculating the overall estimate. The first was that vessels of each flag State and fishing entity operated uniformly across the ocean regions and within size categories. The second was that GRT is an accurate proxy for FAD deployment behavior[12] (i.e. larger vessels use more FADs). Finally, it was assumed that the list of 529 vessels represents all the tuna fishing vessels that utilise drifting FADs. Other vessels that deploy FADs but were not included in this analysis, would necessarily increase the estimate.

[11] Marine Industries-Nautical (Spain); Zunibal Telecommunications (Spain); Satlink (Spain); KANNAD Company (France); Ryokusei (Japan).

[12] The use of GRT to segment the size of the vessels has some limitations since GRT does not necessarily represent the 'best' measure of fishing effort or fish hold capacity; nevertheless, GRT was used because fish hold capacity was not publically available for every listed vessel.

Conclusion

As a result of the paucity of readily available information, estimating the number of drifting FADs deployed in the world's oceans proved to be a challenging and imperfect task. While three separate methods were used in this assessment, none reflect actual FAD usage on the water since a number of assumptions had to be made at each point in the study, however, every attempt was taken to ensure that any such assumptions were conservative. Regardless, the estimated range of 47,000 to 105,000 drifting FADs proffers a good indicator of the overall magnitude of their use.

What we can say with certainty is that tens of thousands of FADs are deployed in the world's oceans every year in a non-transparent manner. Their broader ecosystem impacts and contribution to marine debris are unknown but remain serious cause for concern. There is little information available to the public, nor to the scientists tasked with assessing tuna populations and ecosystem health or government managers charged with making decisions on conservation and sustainable management. However, the data on drifting FADs already exist, and are well known to a select number of people. They now need to be collated, analysed and shared with the public and scientists working to assess the health of tuna stocks around the world. Fishing masters, fleet managers, and satellite-tracked buoy companies know how many FADs are deployed, where they are, and whether or not they are retrieved. To date, there has been no requirement to share this information, while no limits exist on the numbers of drifting FADs that can be deployed. This situation must change.

It is now time for those who rely on drifting FADs to take responsibility and to demystify and communicate how, when, and in what numbers they are used. The ocean and its resources are part of the global commons and are critical to the economic development and food security of many coastal States and local communities. Those who exploit these resources need to act responsibly so that the medium- and longer-term viability of these stocks and the fisheries that depend on them, can be secured. This means collaborating with scientists, minimising waste and providing information to scientists and fisheries managers, so that these fisheries and ecosystems can be kept healthy for generations to come.

CONTACT: Pew Environment Group | international@pewtrusts.org
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Washington, D.C. 20004
Tel. +1 (202)552-2000

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