



Modification of the Current Commercial Minimum Size for Yellowfin and Bigeye Tuna in Hawaii

1. Introduction

The minimum commercial size for ahi (yellowfin and bigeye) sale in Hawaii is 3 lb. These are young of the year fish, measuring about 16 inches for yellowfin and 22 inches for bigeye, and sexually immature. The purpose of this paper is to offer suggestions for a revision to this minimum size for yellowfin and bigeye from federal waters.

2. Background

Hawaii is the world's most isolated archipelago. Data from tagging and otolith studies shows that local fishermen cannot rely on large influxes of yellowfin tuna from other regions to maintain high catch rates and replace harvested stocks. Close to 90% of 1–2 year old yellowfin tuna (15 - 30 lb) sampled in Hawaii in a recent study were locally spawned in Hawaiian waters¹.

Tagging studies show that the vast majority of yellowfin do not leave Hawaiian waters throughout their lifetime^{2,3}. It makes sense to maximize the production and potential benefits from the 'local stock'. Natural mortality rates of Hawaii yellowfin drop to their lowest levels at fairly small sizes (about 24" or 10 lb), i.e. many will survive and grow after this age⁴.

If yellowfin are not harvested at very small sizes, these fish will not be lost to natural mortality or migration. Yellowfin that reach two years old (about 30 lb) will quickly grow to reproductive size and contribute to local spawning and stocks^{5,6,7}.

Larger fish are also more valuable. Table 1 shows the price ranges for different weight categories of yellowfin and bigeye on the auction block in Hawaii

Table 1: Price ranges by size for yellowfin and bigeye tuna on the auction block in Hawaii

Weight	Yellowfin	Bigeye (Longline)	Bigeye (Handline)
3lb	\$1.00-2.00/lb	N/A	\$0.10-\$1.00
15lb	\$1.00-3.00/lb	\$0.50-\$3.00	\$0.50-\$1.00
30lb	\$2.00-4.00/lb	\$1.00-\$4.00	\$0.50-\$2.00
45lb	\$2.00-5.00/lb	\$1.00-\$6.00	\$1.00-\$3.00
60lb	\$3.00-6.00/lb	\$1.00-\$7.00	\$1.00-\$5.00

Source: United Fishing Agency

3. Fisheries for Yellowfin Tuna in Hawaii

Yellowfin tuna is caught commercially by longline, troll and handline vessels (Table 2, Figure 1), with catches taken predominantly by longliners, trollers and handliners. Lesser volumes of yellowfin are also caught by offshore handline vessels and the 1-2 remaining aku boats. Catches from aku boats are confidential as only 1-2 vessels fish annually and thus cannot be reported

publically. Recent total catches have ranged from about 2,700,000 lb to 4,000,000 lb with an annual average of 3,400,000 lb

Table 2. Summary of yellowfin catches by commercial fishing gear in Hawaii in 1000 lb
Source (WPRFMC 2012 & unpublished data)

Year	Longline	MHI Troll	MHI Handline	Offshore Handline	Aku Boat	Total
2003	1,815	732	752	53	73	3,484
2004	1,564	690	770	75	38	3,174
2005	1,624	708	665	67	149	3,248
2006	2,117	590	414	52	6	3,237
2007	1,830	1,032	517	42	50	3,523
2008	1,982	941	437	65	50	3,536
2009	1,119	961	652	46	35	2,857
2010	1,205	884	541	44	15	2,724
2011	2,056	954	695	84	21	3,864
2012	1,915	1316	784	55	0*	4,070
2013	1,547	1068	888	82	0*	3,585

Asterisks indicate confidential data and that catches were > zero

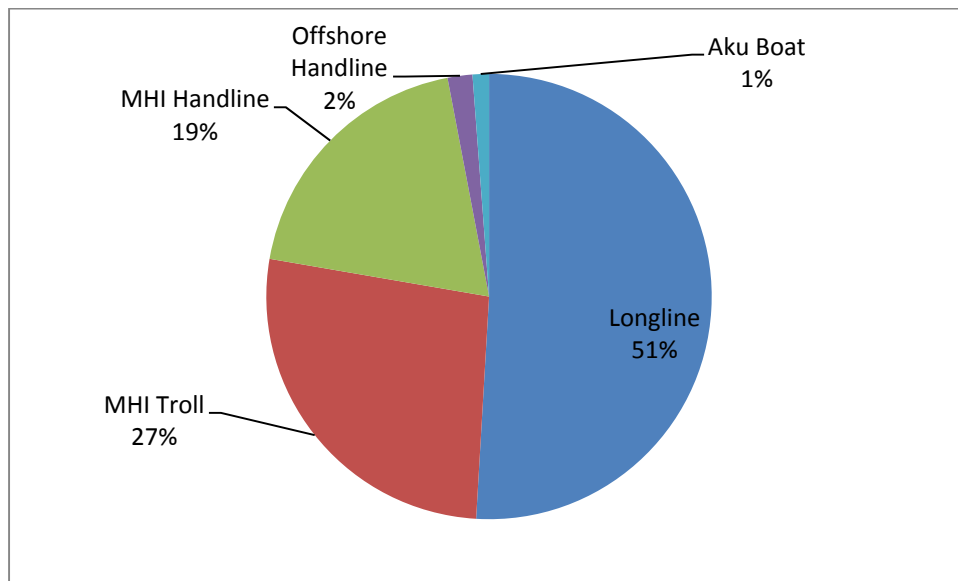


Figure 1. Average percent composition of yellowfin tuna catches in Hawaii by commercial fishing gears, 2003-1013. Source WPRFMC 2012 & unpublished data)

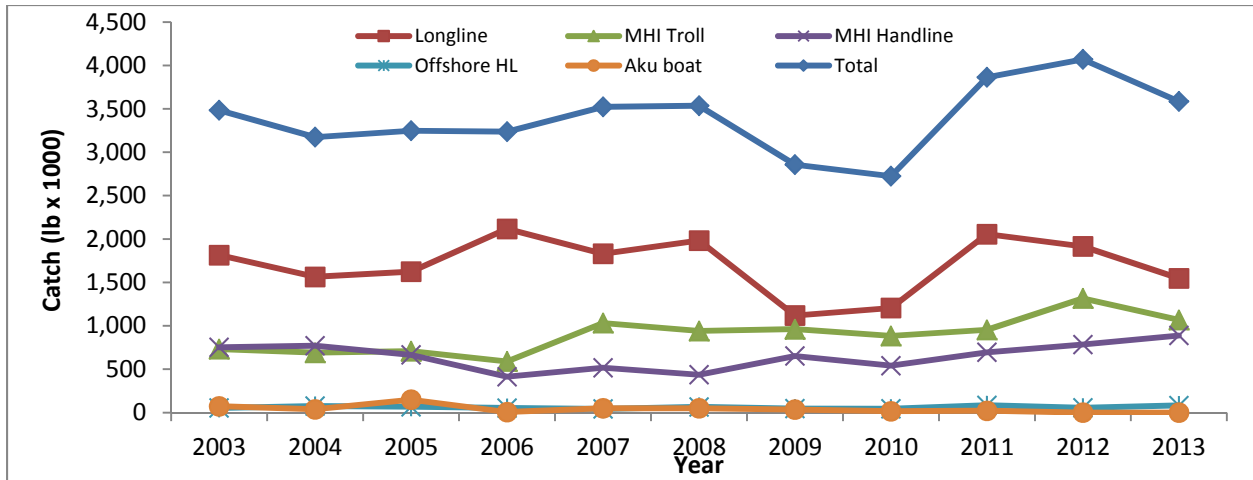


Figure 2. Time series of yellowfin catches by commercial fishing gears in Hawaii, aku boat not shown due to very low catches relative to other fisheries (see Table 1)

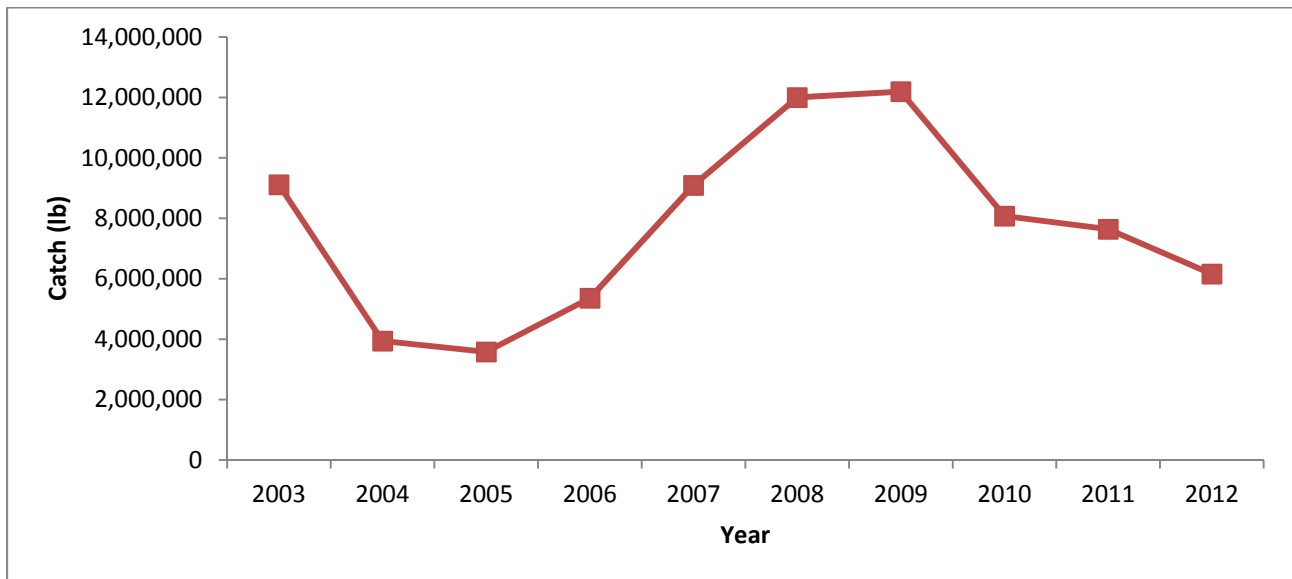


Figure 3. Time series of yellowfin catches by recreational fishing gear in Hawaii

Yellowfin catch in the recreational fishery is shown in Figure 3. Though variable, catches have ranged from 3.5 to 12 million lb, and, are on average twice those of the commercial fishery. The shorter time series is a consequence of the Hawaii Marine Recreational Fisheries Survey (HMRFS) beginning in 2003.

Catch rates in the different fisheries are shown in Figures 4-8 and do not exhibit uniform trends. CPUE in the deeps set longline fishery (Figure 4) has a generally declining trend, as does the offshore handline fishery CPUE (Figure 7). By contrast the CPUE in the troll fishery shows an increasing trend (Figure 5), as does the recreational troll CPUE (Figure 8), while the Main Hawaiian Islands handline CPUE is remarkably stable (Figure 6)

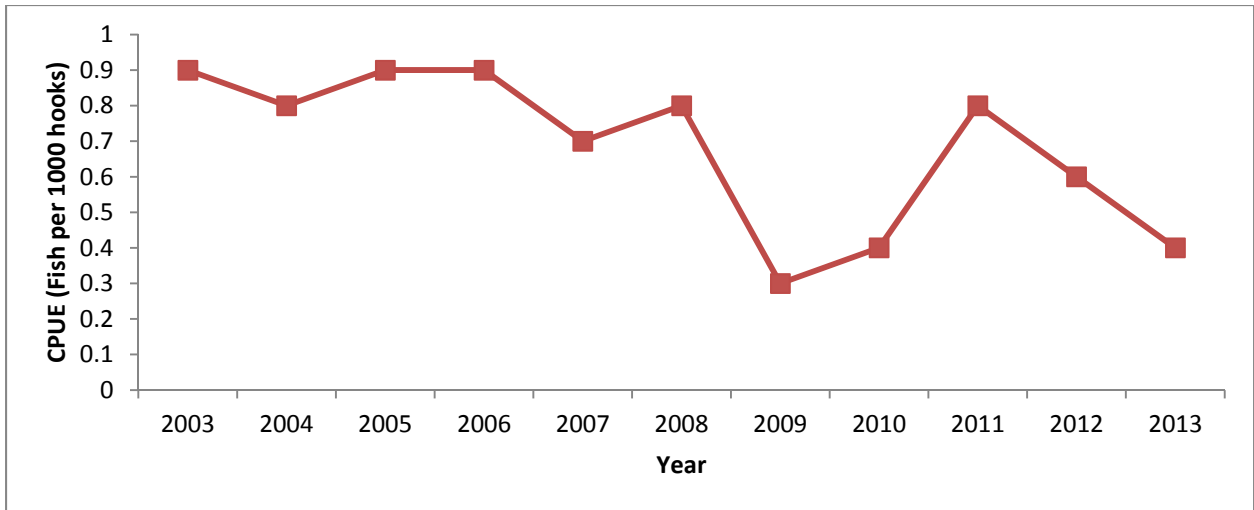


Figure 4. Catch per unit of effort (CPUE) of deep set longline catches of yellowfin tuna by the Hawaii longline fleet

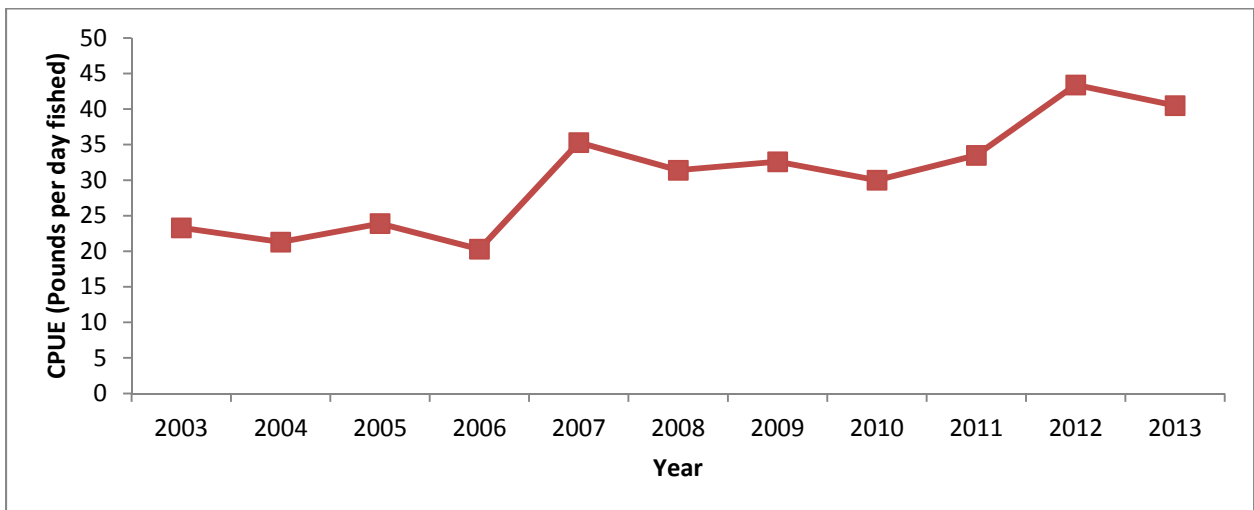


Figure 5. Yellowfin CPUE of the Hawaii commercial troll fishery

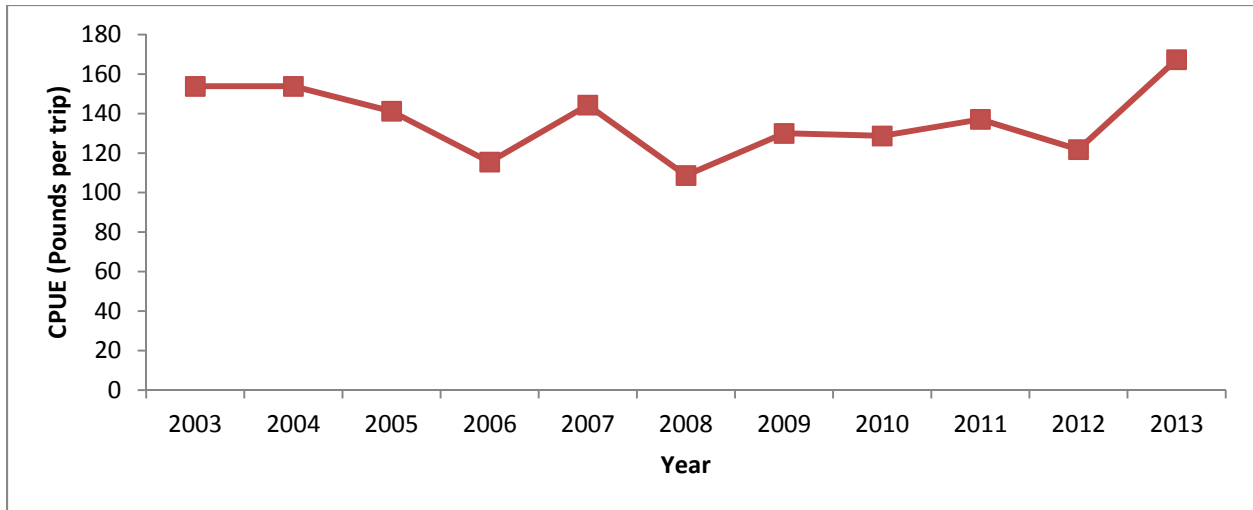


Figure 6. Yellowfin CPUE of the Main Hawaiian Islands handline fishery

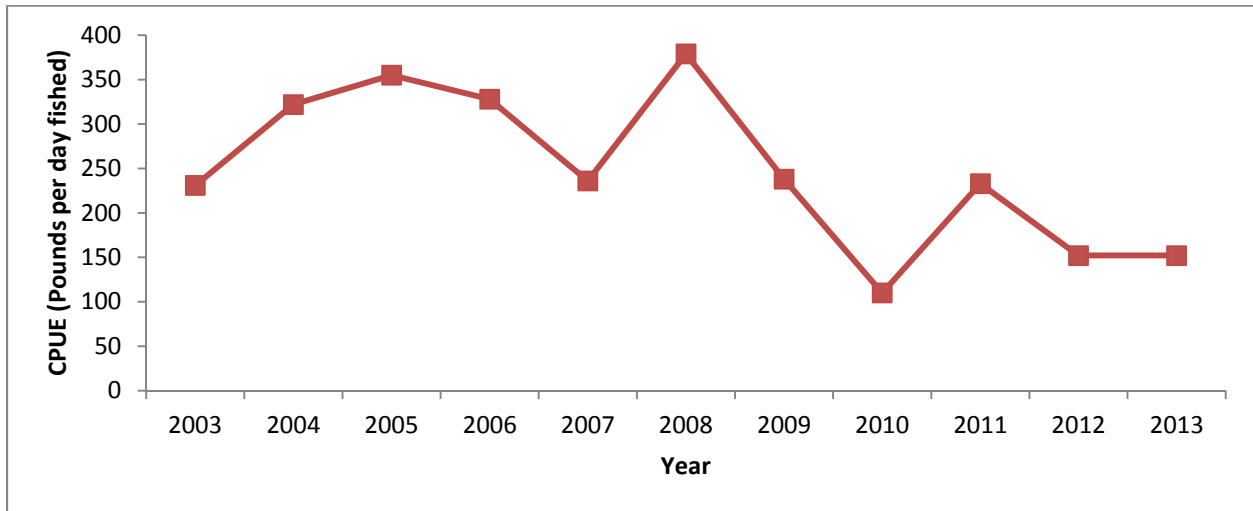


Figure 7. Yellowfin CPUE of the Hawaii offshore handline fishery

Larger yellowfin are caught by the shallow-set longline fishery, although this accounts for only about 6% of the hooks set by the longline fishery overall (Figure 9). Longline caught yellowfin are on average larger than the yellowfin caught by troll and handline gear. Regardless of gear, however, all mean size trends show a positive increase (Figure 9)

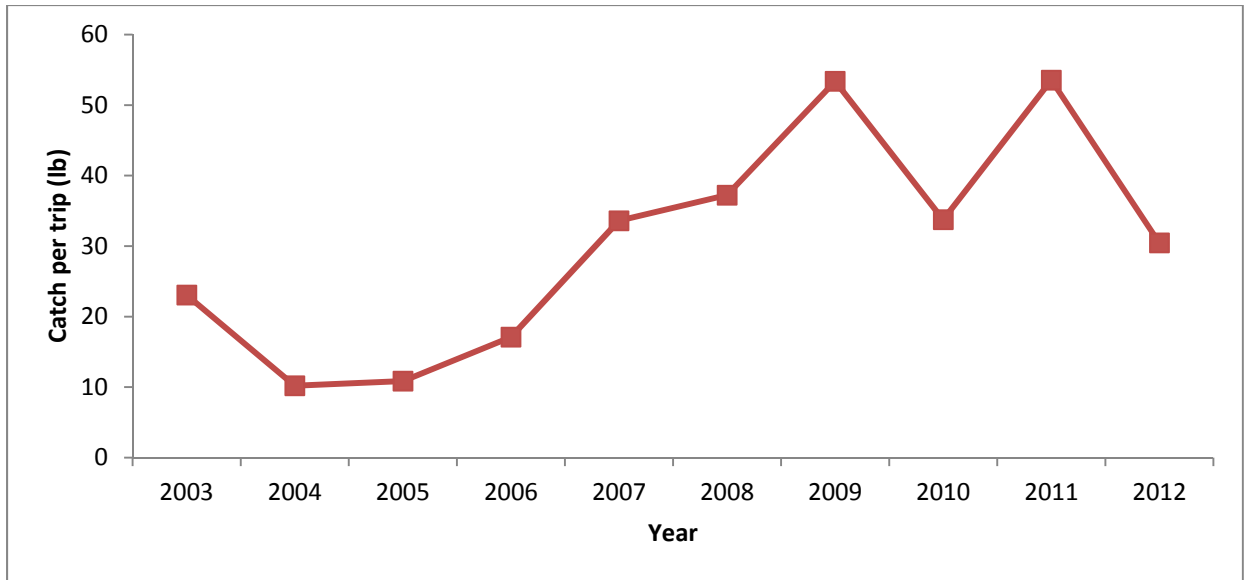


Figure 8. Yellowfin CPUE of the Hawaii recreational fishery (primarily troll) from 2003-2012. Note that sampling of recreational catches in Hawaii began in 2003

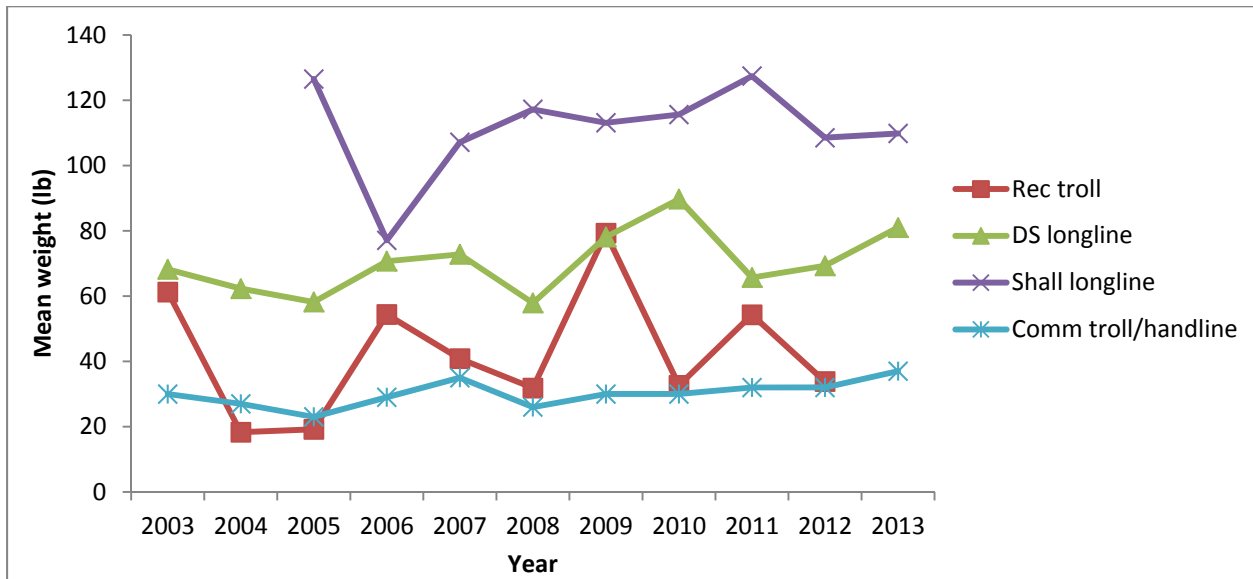


Figure 9. Mean size of yellowfin caught in commercial and recreational fisheries in Hawaii

4. Fisheries for bigeye tuna in Hawaii

Unlike yellowfin, where there is a greater spread of catches by non-longline gears, over 90% of bigeye is landed by the longline fishery, most of it from the deep set fishery which targets bigeye (Table 3, Figure 10). Recent landings have ranged from about 8,300,000 lb to 15,300,000 lb with an average of 12,200,000 lb.

Table 3 Landings of bigeye by pelagic fisheries in Hawaii in 1000s lb, 2003-1013. Source WPRFMC 2012 & unpublished data)

Year	Longline	MHI Troll	MHI Handline	Offshore Handline	Total
2003	7,911	82	75	316	8,384
2004	9,554	328	125	385	10,392
2005	11,033	188	143	345	11,709
2006	9,723	154	135	431	10,443
2007	12,682	140	188	535	13,545
2008	13,025	166	86	245	13,522
2009	10,163	130	70	239	10,602
2010	11,879	261	214	542	12,896
2011	12,421	246	140	515	13,322
2012	12,816	342	141	517	13,816
2013	14,111	325	146	719	15,301

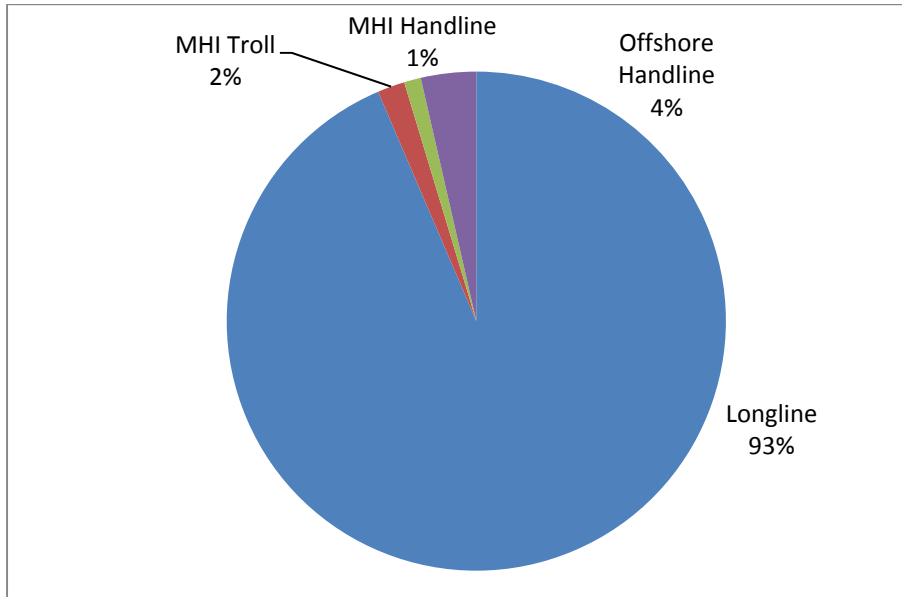


Figure 10. Landings of bigeye in Hawaii by pelagic fishing gears. 2003-1013. Source WPRFMC 2012 & unpublished data)

Unlike yellowfin, bigeye is not frequently caught by the recreational fishermen, but there may be an element of misidentification between small yellowfin and bigeye.

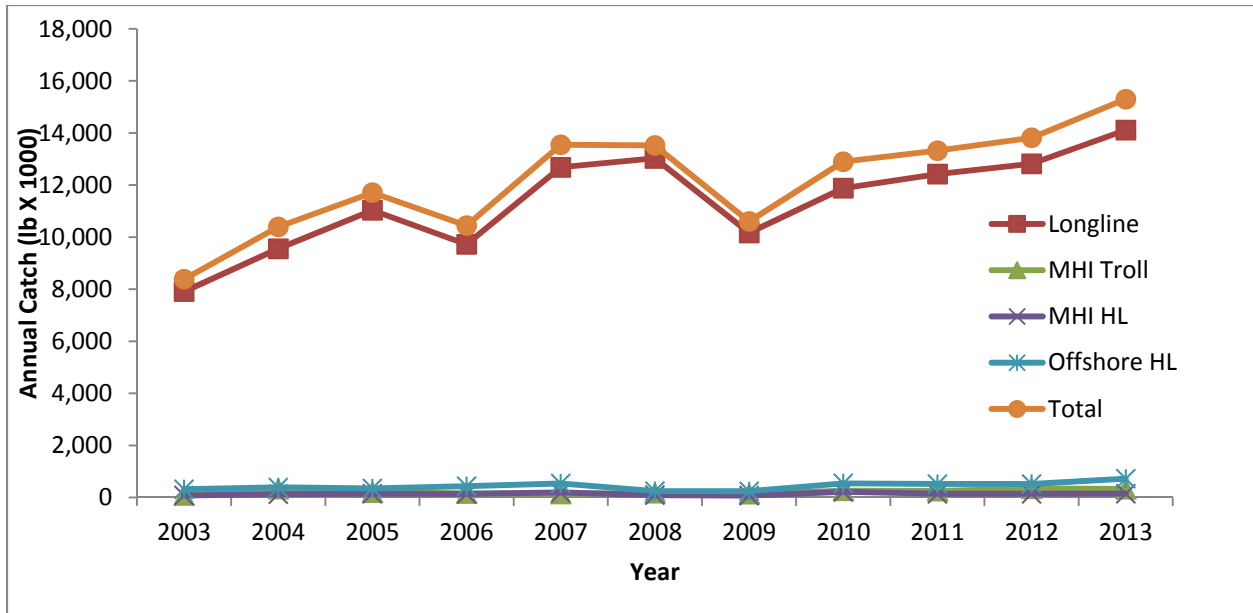


Figure 11. Time series of bigeye catches by commercial fishing gears in Hawaii

Recent commercial catches of bigeye have risen from around 8,000,000 lb in 2003 to 15,000,000 lb in 2013, with an average catch of just over 12,000,000 lb.

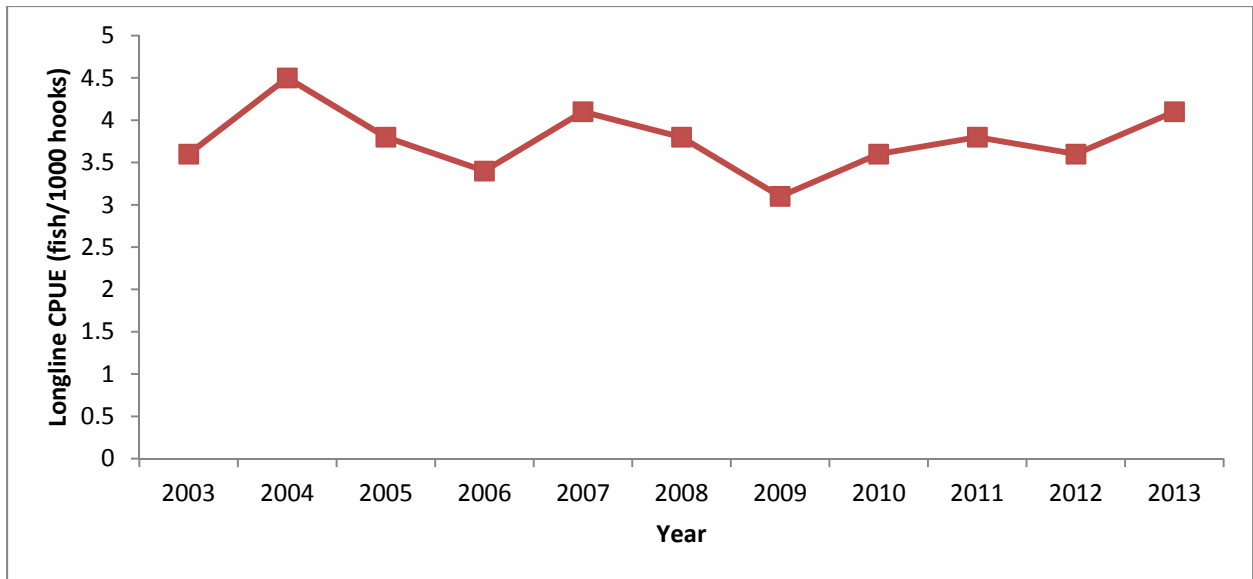


Figure 12. Catch per unit of effort (CPUE) of deep set longline catches of bigeye tuna by the Hawaii longline fleet

Catch rates by the Hawaii longline fishery (Figure 12) have varied between 3.0 to 4.5 fish per 1000 hooks with an average of 3.8 fish per 1000 hooks. The longline deep set trend shows no impacts from the overfishing of bigeye in the Western and Central Pacific (Harley et al 2014).

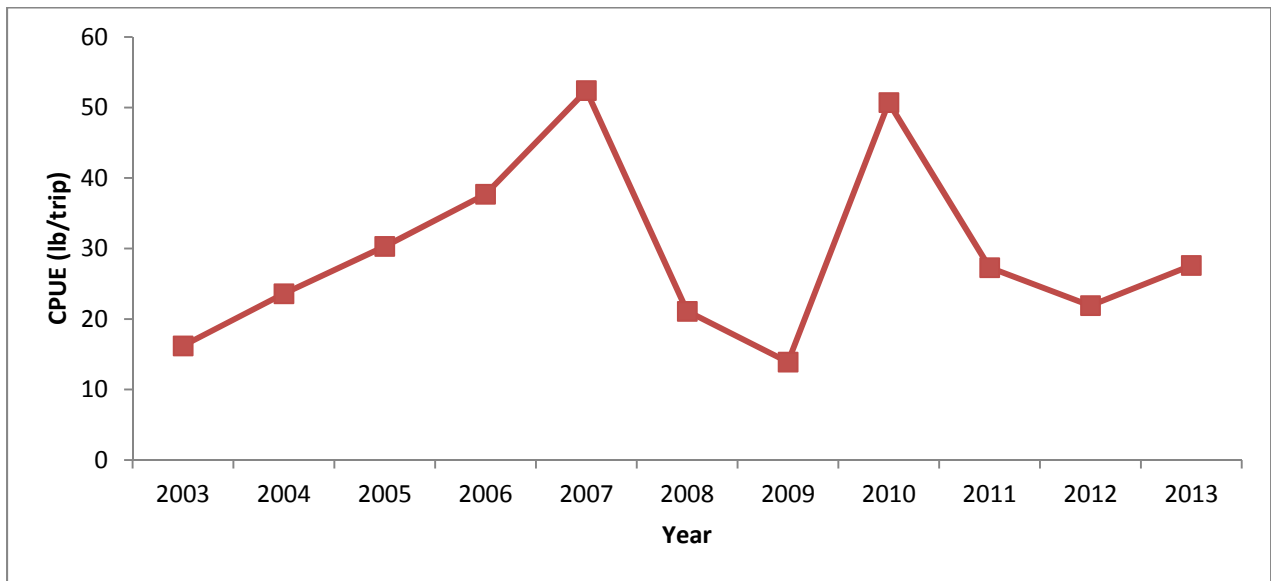


Figure 13. Bigeye CPUE of the Main Hawaiian Islands handline fishery

The Main Hawaiian Islands bigeye handline CPUE has been very variable (Figure 13), with peaks in 2007 and 2010, with catch rates varying from from 13 lb/trip to 50 lb/trip with an average of 29.3 lb/trip.

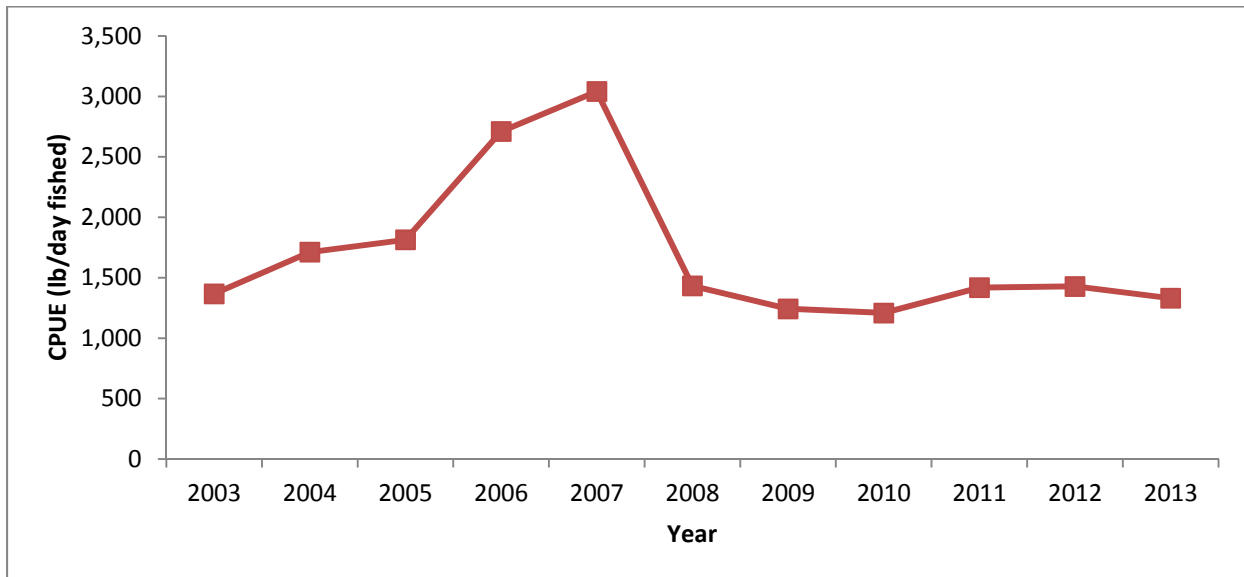


Figure 14. Bigeye CPUE of the Hawaii offshore handline fishery

The offshore handline fishery is the second biggest local supplier of commercially caught bigeye for Hawaii, although this is still a tiny fraction of the overall total. Catches have ranged from 1,200 lb per day fished (Figure 14) to a high of about 3,000 lb per day fished and an average of 1700 lb/day fished.

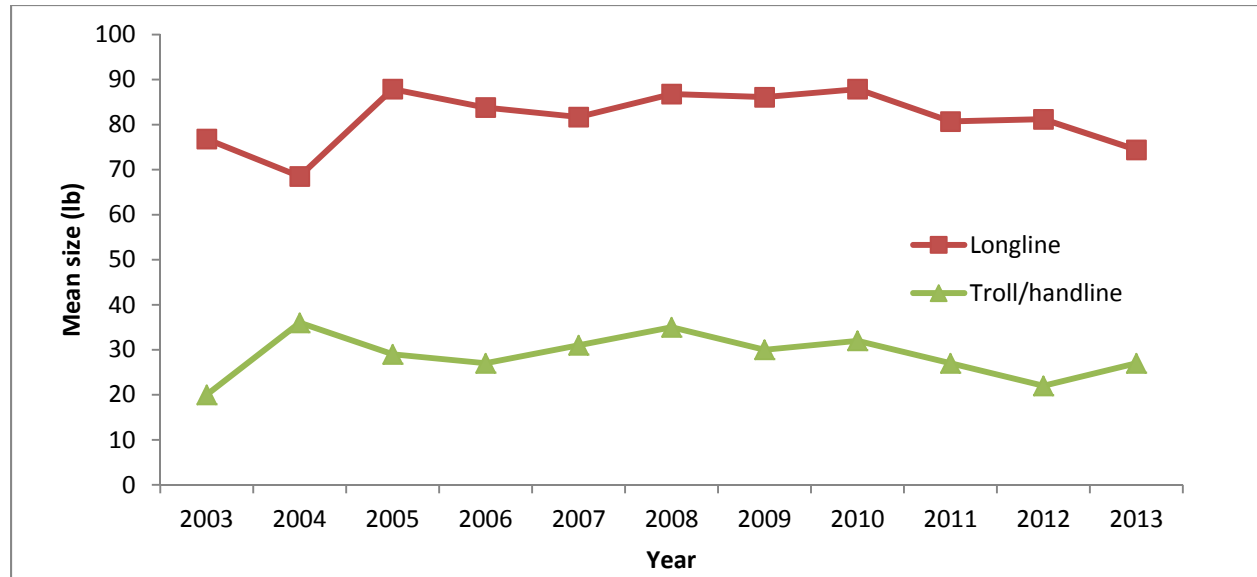


Figure 16. Mean size of bigeye caught in commercial fisheries in Hawaii

The average size of bigeye in longline and the troll handline fisheries (Figure 16) shows a clear differentiation, with smaller fish being caught in the troll/handline fishery (average size = 30 lb) and larger fish in the longline fishery (average size = 80 lb) There are no apparent trends in annual average size in either fisheries, unlike yellowfin (Figure 9) where mean size appears to be increasing.

5. Changing the minimum commercial size

Demand for small sized yellowfin varies from island to island in Hawaii. Three pound minimum sized yellowfin are not often seen on Oahu, but are a common feature of roadside vendors on the Big Island and Maui. There is a demand for small yellowfin from low income families needing a cheap source of protein so any increase in the minimum size needs to account of impacts on those that are the most vulnerable to any change.

Further, the Council can only regulate catches of yellowfin within federal waters and the State would need to make a parallel rule consistent with any new minimum size adopted for federal waters. Without State agreement on a new minimum size for yellowfin, and federal regulation would be hard if not impossible to enforce. Further, there is no minimum size stipulation for recreationally and yellowfin is caught in abundance by recreational fishermen, many of whom have a State of Hawaii commercial marine license (CML) and thus may sell their fish.

There has been no structured consultation with the public to change the minimum size for yellowfin, other than two informal surveys conducted in 2012 at the Honolulu Seafood and Fishermen’s Festival and the Council’s Fisher’s Forum, both held in October of that year. Participants were asked to select a size range (3 lb, 10-19 lb, 20-29 lb, 30-39 lb, 40-60 lb) and vote for their preference. Voters at the Seafood Festival were primarily the public at large, while at the The Fisher’s Forum the voters were predominantly fishermen or workers in the fishing and seafood industries.

The surveys were unscientific and were different orders of magnitude (259 vs 63, see Figure 1), and are indicative of preferences in the public and fishing community.

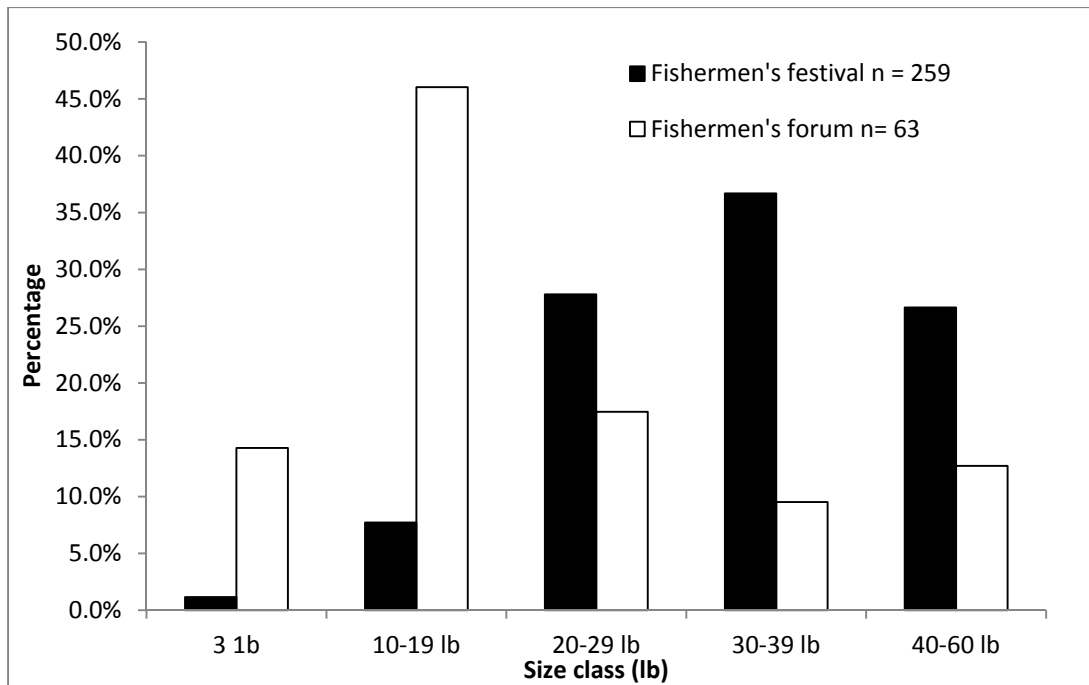


Figure 10. Results from two informal survey exercises with the general public and fishermen as to preference for a new commercial minimum size for yellowfin tuna

The general public selected a larger minimum size classes with a mode between 30-39 lb, and a weighted mean of 34 lb. Fishermen, perhaps unsurprisingly were more conservative with a mode in the 10-19 lb size class, and weighted mean of 21 lb. Nothing further should be read into these two polling exercises other than different groups are likely to respond differently, and that a properly structured randomized stratified survey should be conducted of fishermen, the seafood industry in general and consumers to get a better idea of the preferences for a new commercial minimum size for yellowfin tuna

5. Options for a new minimum size

a. Maintain current minimum size

Maintaining the current 3lb minimum size for yellowfin and bigeye is the path of least resistance, though it would mean young-of-the-year fish would continue to be caught when they are experiencing their highest natural mortality rate.

b. Establish a new 10 lb minimum size for yellowfin and bigeye from federal waters

As noted earlier in this paper, the key to a new minimum size should be tied to the life-history of the yellowfin caught around Hawaii. Fish that weigh 10-15 lb experience the lowest natural mortality rates, meaning that if not caught and landed these fish have every opportunity to grow to three year olds or about 60lb when 50% of them will be sexually mature and begin contributing recruits to the population. If Hawaii cannot expect much subsidy for its yellowfin stock from waters beyond Hawaii then a minimum size that promotes maximizing recruitment is clearly a good management strategy. Bigeye should be included in the measures because they are hard to distinguish when small, and are subject to overfishing in the Western and Central Pacific Ocean

c. Establish a 20 lb minimum size for yellowfin and bigeye from federal waters

Based on the polling evidence there is some support for a 20 lb minimum size among fishermen but this comes with all the caveats as described earlier. It should be noted that there is a market demand for small bigeye, to the point where even a 10 lb minimum is unlikely to be universally popular. As with the 10 lb minimum size, fish in 20 lb size category continue to experience low natural mortality rates, meaning that if not caught and landed these fish have every opportunity to grow to three year olds or about 60lb when 50% of them will be sexually mature and begin contributing recruits to the population.

References

- Dagorn, L., Holland, K.N. and D.G. Itano 2007. Behavior of yellowfin (*Thunnus albacares*) and bigeye (*T. obesus*) tuna in a network of fish aggregation devices (FADs). *Mar. Biol.* 151:595–606
- Hampton, J. 2000. Natural mortality rates in tropical tunas: size really does matter. *Can. J. Fish. Aquat. Sci.* 57(5): 1002-1010.
- Harley, S., N. Davies, J. Hampton, S. McKechnie. 2014. Stock Assessment of Bigeye Tuna in the Western and Central Pacific Ocean. WCPFC-SC10-2014/SA-WP-01.
- Itano, D.G. 2000. Reproductive biology of yellowfin tuna (*Thunnus albacares*) in Hawaiian waters and the western tropical Pacific Ocean: Project Summary. UH SOEST Pelagic Fisheries Research Program Report 00-01, 69 pp.
- Itano, D.G. and K.N. Holland 2000. Movement and vulnerability of bigeye (*Thunnus obesus*) and yellowfin tuna (*T. albacares*) in relation to FADs and natural aggregation points. *Aquat. Living Resour.* 13 (2000) 213–223

- Uchiyama, J.H. and P. Struhsaker 1981. Age and growth of skipjack tuna (*Katsuwonus pelamis*), and yellowfin tuna (*Thunnus albacares*), as indicated by daily growth increments of sagittae. Fish. Bull. 79 (1), 151-162.
- Uchiyama, J.H. and T.K. Kazama 2003. Updated weight-on-length relationships for pelagic fishes caught in the Central North Pacific Ocean and bottomfishes from the Northwest Hawaiian Islands. NMFS PIFSC Admin. Rep. H-03-01, 46 pp
- Wells, R.J., Rooker, J.R. and D.G. Itano 2012. Nursery origin of yellowfin tuna in the Hawaiian Islands. Mar. Ecol. Prog. Ser. 461:187-196.