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Marlin management in Hawaii: Are there interactions between longline vessels and charter vessels targeting blue and striped marlin?

by

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Abstract

A study was conducted of the Kona-Honokohau charter vessel catches of blue and striped marlins, and the revitalization of the Hawaii-based longline fleet in the late 1980s. An increase in longline catch of marlins was believed to have had a negative effect on the charter vessel blue marlin catches. The main conclusions from this study were that the level of longline fishing inside the US EEZ bordering the Hawaiian Islands does not have a significant influence on blue marlin and striped marlin charter vessel troll CPUEs. The main influence on charter vessel CPUE for blue marlin may be the annual volume of charter vessel activity.

Introduction

In this paper I present an update and revision of the paper first delivered to the Symposium on Pacific Islands Gamefish Tournaments, held in Hawaii between July 29 and Aug 1 1998. The objective of this contribution is to assess the evidence for interactions between Hawaii-based longline vessels and coastal charter vessels based at Kona on Hawaii with respect to blue marlin. Specifically, has the revitalization and expansion of the Hawaii-based longline fishery in the late 1980s and 1990s had a negative influence on the catches of blue marlin by the near-shore charter troll fishery, the largest component of which is based at Honokohau, a small boat harbor near the Hawaiian town of Kona.

In the Western Pacific Region, blue marlin is a target species primarily of recreational gamefishing enthusiasts and charter vessels. Some targeted harvest of blue marlin in Hawaii by commercial trollers occurs between August to October, when large schools of 100-300 lb fish aggregate around fish aggregating devices (FADs) deployed off the Waianae coast of Oahu. Most blue marlin caught either by charter vessel or commercial trolling in Hawaii is usually sold through the commercial fish auctions. Even predominantly recreational fishers may also dispose of blue marlin through the auction, although a larger percentage is kept for personal consumption. Commercial troll landings of blue marlin in Hawaii during 1997 amounted to

about 760,000 lbs, although this is likely an underestimate due to the non-reporting of "recreational" catches.

The longline fishery in Hawaii, which targets mainly swordfish and tunas, also takes blue marlin as an incidental catch. Landings of blue marlin from the longline fishery presently amount to about 1,000,000 lbs (WPRFMC 1998), or about 4.0% of total landings. Logbook estimates suggest that about 3 % of the blue marlin caught is discarded. Competitive interactions between trolling vessels targeting marlins and longline fisheries have been the focus of investigations in Hawaii, the Marshall Islands and Mexico. In Hawaii, Boggs (1991) and Skillman et al (1993) investigated the interaction between longline and troll vessels with respect to a variety of pelagic species. Boggs (1991) showed that there was no apparent relationship between blue marlin troll catch rates and the build up of longline fishing effort in the Hawaii EEZ. However, Skillman et al (1993) suggested that intense longline fishing near the Hawaiian islands may have the potential to depress catch rates of species such as blue marlin.

Longline fishing has been conducted in Hawaii since the early years of the 20th Century but the fishery experienced a decline in participation from a peak of about 50 vessels in the mid 1950s to less than 20 by the early 1980s. These vessels were generally wooden hulled sampan style vessels using tarred rope longlines stored on deck in baskets and commonly referred to as "basket gear".The discovery of fishable stocks of swordfish to the north of Hawaii and the advent of larger steel hulled vessels equipped with monofilament line on steel drums revitalized the fishery, which expanded through relocation of vessels from the US mainland. The rapid expansion of the fishery also created problems, particularly the perception that the expansion of longline fishing meant competition with small troll vessels. In a series of amendments to its pelagics fishery management plan, the Western Pacific Council implemented log book and observer programs, and a 50-75 nm closed area around the Main Hawaiian Islands and a 50 nm closed area around the Northwestern Hawaiian Islands.

The displacement of the longline vessels to at least 50 nm miles offshore allieviated most of the tension between small troll vessels and longliners. However, there is still the perception that longliners are catching blue marlin that if left would be caught by troll vessels, particularly charter vessels which target principally big game fish such as marlins. One recent appeal to the Western Pacific Fishery Council asked for an extension of the present area closure boundary adjacent to the western coast of the Big Island, in an attempt to allocate more blue marlin to the State's main charter vessel fishery based out of Kona (Bright 1997). This request fostered a series of investigations by the Council in partnership with the NMFS Honolulu Laboratory and Hawaii Division of Aquatic Resources, which looked at any evidence that showed the Hawaii-based longline fishery had a strong negative influence on the Kona charter fishery blue marlin catch. The results of this study are summarized in this paper, which focuses primarily on blue marlin but also includes the striped marlin which is also caught in abundance by both longline and charter fisheries..

Methods

Catch and effort data for charter troll vessels based at the Honokohau small boat harbor near Kona for the years 1980 to 1998 were obtained from the Hawaii Division of Aquatic Resources in Honolulu. All commercial fishing vessels in Hawaii are obliged to complete a trip catch report, detailing the catch for each trip and its disposition, i.e. kept or sold. Charter vessels in Hawaii in the main retain and sell their catches to supplement incomes from charter patron fees. Data for Honokohau resident charter vessels were summarized for the years 1980 to 1998. The data included total number of trips by individual vessels in each year and the daily catch by weight and numbers of different species of fish. For this study only blue marlin and striped marlin were extracted from the catch data. The only measure of fishing effort was the individual trip, however, this has been shown by Boggs and Ito (1993) to be a reasonable proxy for true fishing effort in Hawaii small vessel troll fisheries.

Hawaii-based longline vessel operators are obliged to complete daily records of their fishing operations in logbooks supplied by the National Marine Fisheries Service, which include recording catch in numbers of commercial species such as blue and striped marlin. Longline effort is expressed as the number of hooks deployed and catch per effort as catch per 1000 hooks. Records of longline catches also report the location of the start and finish of a set and the catch data can be expressed spatially in summaries by 5 degree squares.

Results

The main data set generated from the HDAR charter vessel fishery is shown in Table 1. Also included in Table 1 is the annual fleet size of longline vessels and the number of hooks set each year in the 5 degree square bounded by the coordinates 155-160 deg W, 15-20 deg N, and which includes the Kona coast of Hawaii . Figure 1 shows the time series trajectories for total charter vessel trips and blue and striped marlin catches between 1980 and 1998. The most striking feature of the charter vessel fishery over the last 20 years has been the expansion of the charter fishing in the late 19980s and early 1990s. During the 1980s annual charter trips ranged from 1000 to 1500 trips annually, while during the 1990s the volume of charter trips ranged from between 3000 and 3500 trips per year. This has led to an increase in blue marlin catch and to a lesser extent striped marlin.

Figure 2 and shows the catch per unit effort (CPUE) for blue and striped marlin together with the annual fleet size of longline vessels. Catch rates for blue marlins ranged from 0.2 to 0.6 marlin/trip, with and average of 0.38 marlin/trip, while striped marlin catch rates have ranged from 0.03 to 0.3 marlin/trip, with an average of 0.08 marlin/trip. Both marlins showed a peak in CPUEs in the late 1980s, although the blue marlin peak was sustained over several years. Catch rates of both marlins attained lows both before and after the advent of the revitalized longline fishery.

Table 1. Annual catch, effort, CPUE of the Honokohau charter vessel fishery for blue and striped marlin, annual longline fleet size (1980-1998), and annual number of hooks deployed in the 5 degree square bordering the Kona coast of Hawaii (1991-1998)

Year		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
	no	81	50	39	50	64	56	85	108	285	191
	wt	5,712	3,330	2,777	3,222	4,453	4,686	7,420	7,236	20,504	12,160
Striped marlin	no trips	1,187	1,608	891	1,590	889	1,003	1,153	838	755	1,485
	cpue (n/trip)	0.068	0.031	0.044	0.031	0.072	0.056	0.074	0.129	0.377	0.129
	cpue (lb/trip)	4.812	2.071	3.117	2.026	5.009	4.672	6.435	8.635	27.158	8.189
	no	432	521	360	466	253	628	399	544	508	936
	wt	111,819	142,830	95,510	114,652	62,186	107,784	103,215	115,424	102,014	175,643
Blue marlin	no trips	1187	1608	891	1590	889	1003	1153	838	755	1485
	cpue (n/trip)	0.364	0.324	0.404	0.293	0.285	0.626	0.346	0.649	0.673	0.630
	cpue (lb/trip)	94.203	88.825	107.194	72.108	69.951	107.462	89.519	137.738	135.118	118.278
Longline fleet size (n)		22	25	27	37	38	42	46	45	55	75

Year		1990	1991	1992	1993	1994	1995	1996	1997	1998
	no	179	193	161	356	225	169	213	163	73
	wt	13757	12820	12230	25817	16211	10286	14490	11211	4648
Striped marlin	no trips	3051	2270	2624	3551	3443	3216	3395	2752	2402
	cpue (n/trip)	0.059	0.085	0.061	0.100	0.065	0.053	0.063	0.059	0.030
	cpue (lb/trip)	4.509	5.648	4.661	7.270	4.708	3.198	4.268	4.074	1.935
	no	1005	774	804	716	1587	662	1063	731	717
	wt	246579	169315	183117	149556	316510	150888	220410	141499	154769
Blue marlin	no trips	3051	2270	2624	3551	3443	3216	3395	2752	2402
	cpue (n/trip)	0.329	0.341	0.306	0.202	0.461	0.206	0.313	0.266	0.299
	cpue (lb/trip)	80.819	74.588	69.785	42.117	91.929	46.918	64.922	51.417	64.433
Longline fleet size (n)		100	141	123	122	125	110	103	105	114
Longline effort in 5 deg square		NA	2035	2154	1444	1486	1921	3099	2722	2363

Figure 1. **Time series of blue and striped marlin catch (n) and charter vessel fishing effort (trips) for Kona, 1980-1998**

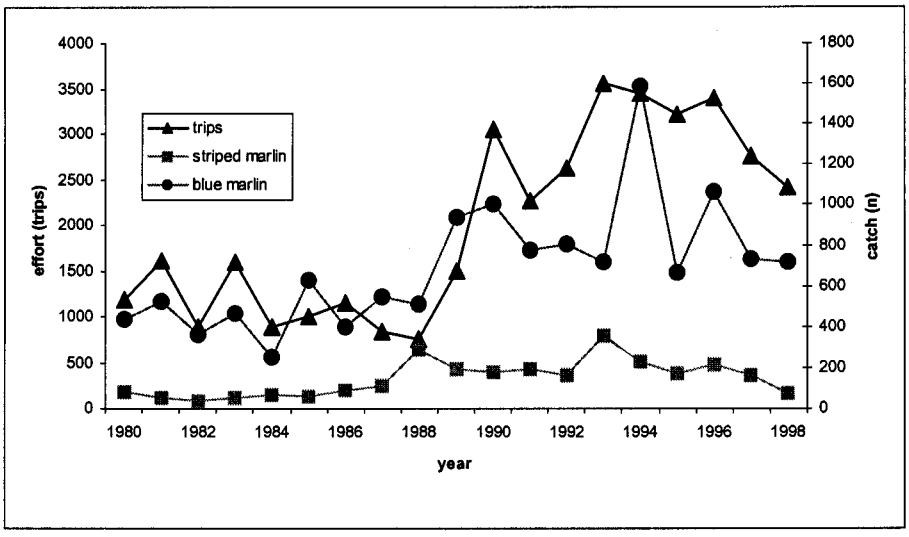


Figure 2. **Time series of blue and striped marlin CPUE for the Kona charter-vessel fishery, and Hawaii longline fleet size, 1980-1998**

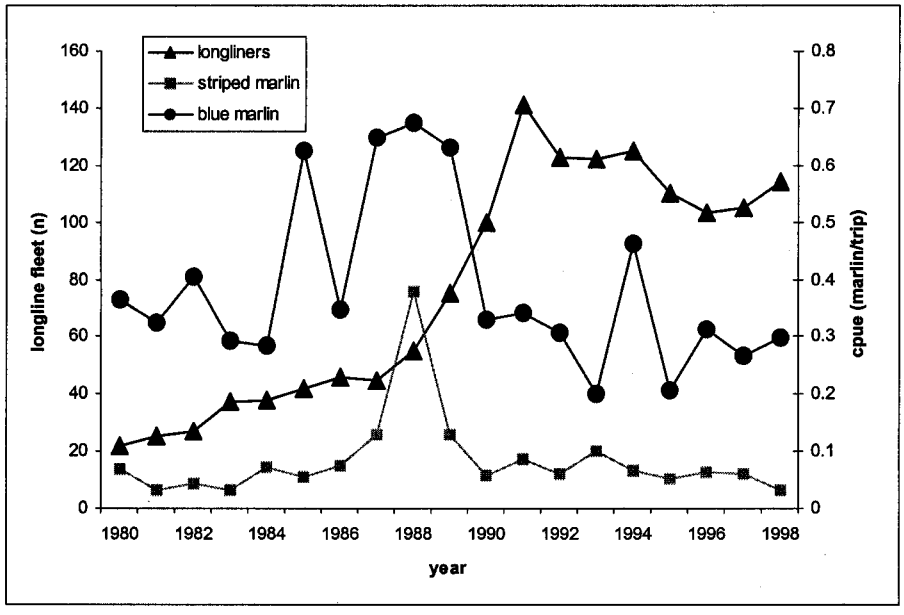


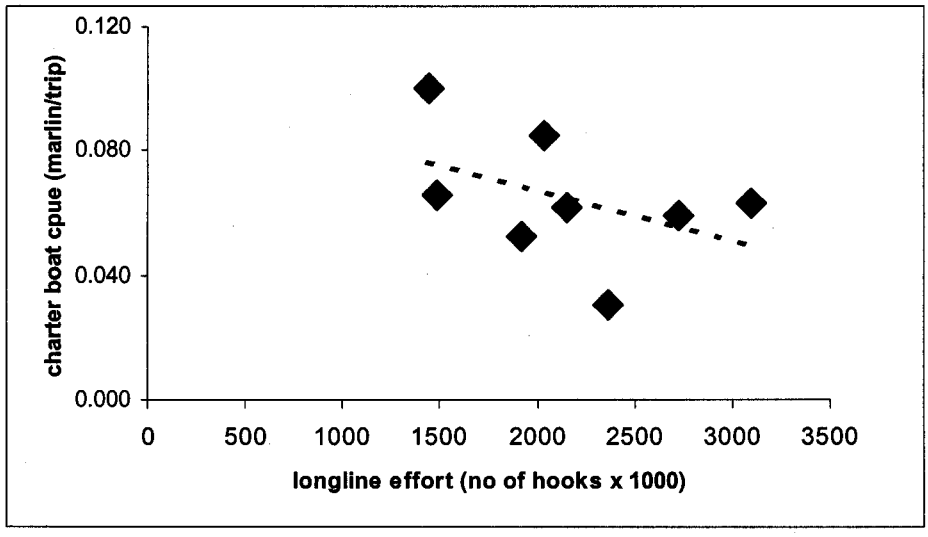
Table 2. Summary of regression analyses based on data contained in Table 1

Factor	Blue marlin charter vessel CPUE (N)	Blue marlin charter vessel CPUE (wt)	Striped marlin charter vessel CPUE (N)	Striped marlin charter vessel CPUE (wt)
Annual longline fleet size (N)	-0.1095	-0.5471*	-0.0794	-0.093
Annual longline effort (hooks) in 5 deg square	-0.0854	-0.0321	-0.4492	-0.4648
Annual charter vessel effort (trips)	-0.5718*	-0.7361*	-0.3156	-0.3237

* $p < 0.05$

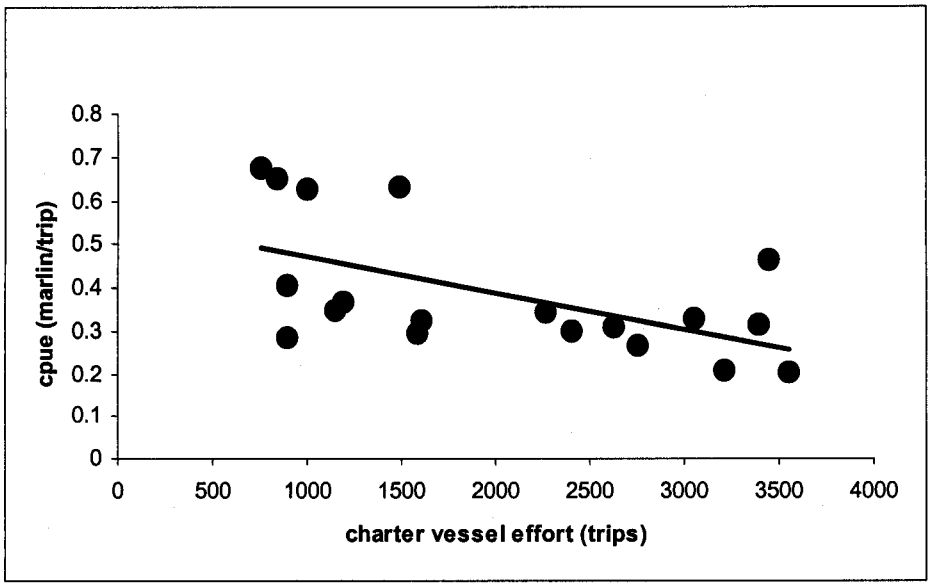
A number of simple linear regressions were conducted on blue and striped marlin CPUE with longline fleet size, annual fishing effort in the 5 degree square containing the Kona coast, and annual charter vessel fishing effort. The matrix of results from these analyses is contained in Table 2. With respect to longline fishing effort, only blue marlin CPUE by weight was significantly correlated to annual fleet size. Fleet size is, however, a very crude representation of annual effort, given the mobility of the fleet and its ability to switch targeting through fishing at different depths. More accurate longline effort data in terms of number of hooks set in a 5 degree square off Kona from 1991 to 1998 were also available to investigate possible interaction effects.

Figure 3. Charter vessel mean annual CPUE for striped marlin versus longline fishing effort in a 5 degree square bordering the Kona coast. Fitted line is not significant.



Regressions of marlin CPUE versus longline effort were also not significant (Table 2), although there may be possibly be some suggestion of a negative relationship between longline effort and striped marlin CPUE (Figure 3). Blue marlin CPUE was negatively correlated with annual charter vessel effort (Figure 4), with the best fit to the data being achieved when blue marlin CPUE was expressed in weight rather than numbers (Table 2). No relationship was evident for striped marlin CPUE and annual charter vessel effort.

Figure 4. Annual mean charter vessel CPUE for blue marlin versus annual total charter vessel number of trips by Honokohau-based charter vessels

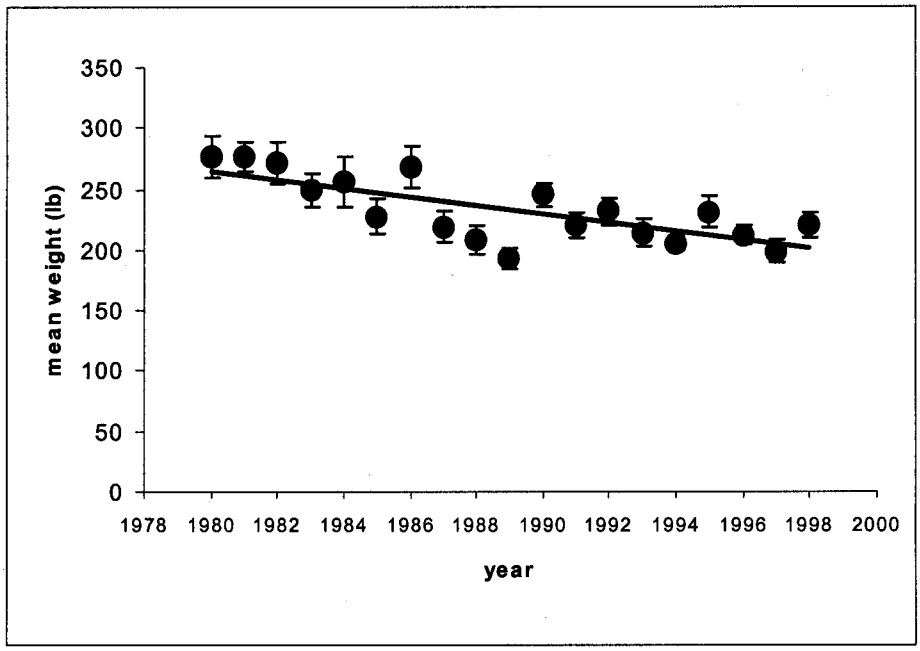


Discussion

Charter vessel CPUEs are highly variable and have attained lows both before and after the revitalization of the Hawaii-longline fishery, however, the three year period of high CPUEs for blue marlin and to a lesser extent for striped marlin during the expansion phase of the longline fishery in the late 1980s may have 'colored' charter vessel operators perceptions to the subsequent long period of relatively low CPUEs during the 1990s. There was a significant correlation between annual longline fleet size and charter vessel blue marlin CPUE in terms of weight, but not CPUE by number. This correlation is probably therefore spurious and more likely reflects the declining average weight of blue marlin from 1980 onwards (Figure 5). The reasons for this decline in weight is unknown but possibly reflects the overall influence of cumulative catches by longliners and purse seiners in the Central-West Pacific over the past 5 decades. A similar decline in striped marlin was not apparent.

Further, a more accurate level of longline fishing effort in terms of longline hooks set in the 5 deg square bounding Kona showed no correlation with blue marlin CPUE (Table 2). The same

Figure 5. Annual mean size of blue marlin caught by charter vessels based at Honokohau small boat harbor



measure of longline effort was also not significantly correlated with the charter vessel CPUE for striped marlin, but the scatter of points indicates that there might be a weak relationship between longline effort and striped marlin CPUE. Striped marlin CPUE (Figure 3). it should be pointed out also that prior to 1992, longline vessels could fish within the 50-75 nm *cordon sanitaire* or exclusion zone and there may have been some stronger interactions but which can not now be identified.

The best correlations obtained with this data indicate that the most direct influence on blue marlin charter vessel CPUE may be the level of charter vessel fishing activity. The Honokohau small boat harbor continues to grow, and the State of Hawaii continues to offer charter vessel berths there as a revenue earner. Fishing principally for blue marlin is conducted in a relatively narrow area of the Kona coast, and the need not to have to travel long distances offshore to fish is one of the main attractions of this location. Spatial analyses of the charter vessel catches is not possible with the available data as this is spatially aggregated over relatively large areas. However, the data on catches in the Hawaii International Billfish Tournament (HIBT) from 1959 to 1995, aggregated over nearly 4 decades (Davie 1995, Seki 1996) show that most blue marlin are caught in a narrow band of sea bordering the coast. The relatively low blue marlin CPUEs during the 1990s may simply reflect the increase of fishing effort by charter vessels along the Kona coast, with a concomitantly lower share of the catch per fishing vessel.

The main conclusions from this study are that the level of longline fishing inside the US EEZ bordering the Hawaiian Islands does not appear to have a significant influence on blue marlin and striped marlin charter vessel troll CPUEs. The main influence on charter vessel CPUE for

blue marlin may be the annual volume of charter vessel activity. If this is the case, then the State of Hawaii needs to re-examine its policies concerning Honokohau small boat harbor, given that the success of catching a blue marlin (currently about one in every three trips) may influence future charter vessel patronage.

Acknowledgments

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