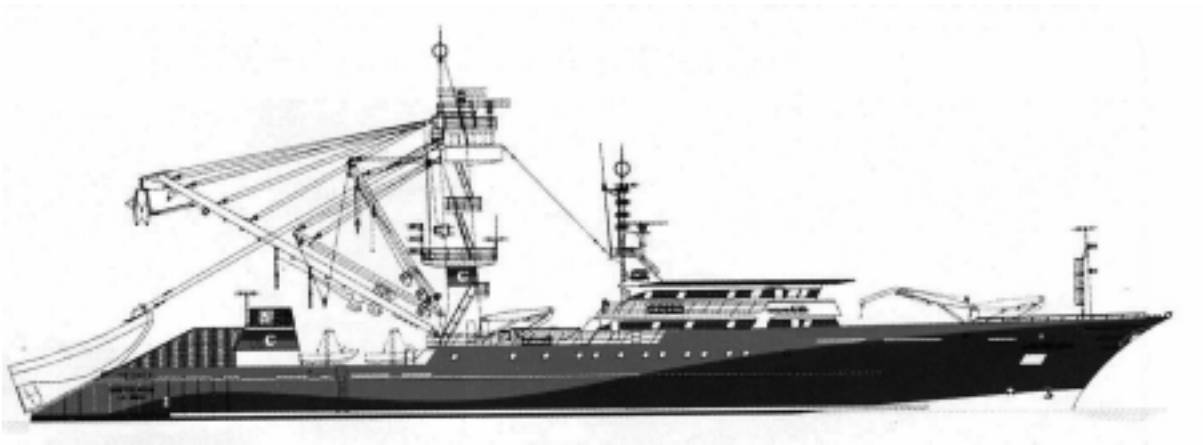
SCTB16 Working Paper

FTWG–2

Updates (2003) of factors that may have affected U.S. purse seine catch rates in the central-western Pacific Ocean: an examination of fishing strategy and effective fishing effort.



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Update of factors (2002) that may have affected U.S. purse seine catch rates in the central-western Pacific Ocean: an examination of fishing strategy and effective fishing effort[1]

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INTRODUCTION

U.S. purse seiners have been fishing in the central-western Pacific Ocean (CWPO) since 1974. The fishery catches mainly skipjack tuna (*Katsuwonus pelamis*) with lesser quantities of yellowfin (*Thunnus albacares*) and bigeye (*T. obesus*) tuna. In June 1988, the U.S. and 16 Pacific Island Nations entered into a Treaty that gave U.S. purse seiners access to a large area of the central-western Pacific in exchange for license fees, economic aid, and fisheries data. As a result of the Treaty, a comprehensive data set consisting of landings, logbook and length-frequency information has been maintained for fisheries research.

The data indicate that the U.S. purse seine fleet fished from 1988 to 1995 in the CWPO by setting on free-swimming and log associated tuna schools at a ratio close to 4:1, i.e. mainly on schools of free-swimming tuna (Figure 1). Since 1996, the searching and fishing strategy of the fleet changed dramatically with a distinct shift toward fishing on schools associated mainly with drifting Fish Aggregation Devices (FADs) and also other floating objects such as logs. Changes brought about by the shift to FAD associated fishing strategy may have affected many vessel performance statistics such as catches, species composition, and catch rates; statistics calculated during the pre-FAD period prior to 1996 may not be directly comparable to those collected after 1996 (Figure 2). This study updates previous studies submitted to the Fishing Technology Working Group at the 14th and 15th meetings of the Standing Committee on Tuna and Billfish (SCTB) by adding data for 2002. Landings, logbook, and vessel specification data from a portion of the U.S. fleet that fished continually during the 1988 to 2002 period are examined and changes in catch rates and other vessel performance indicators caused by the fleet's shift to FAD fishing are documented. Length and species composition data for 1988 to 2001 are also examined for the presence of bigeye tuna and small fish (<7.5 lbs) in the landings.

DATA

Landing records for all CWPO-based U.S. purse seiners were reviewed and vessels that fished continually (at least 1 trip annually) during the 1988 to 2002 period were selected. Thirteen vessels met this criterion (15 fished the entire period 1988-2000, 14 for 1988-2001 and 13 for 1988-2002). Of the 13 selected vessels operating in 1988 to 2002, only two

increased fishing capacity in 2000 (1,200 short tons (st) to 1,850 st and 1,200 st to 2,000 st[2]). The average fishing capacity of the 13 selected vessels during 1988-2002 was 1,291 st.

The 13 selected vessels represent an average of 35% of the U.S. fleet (numbers of vessels) and 28% of the fleet's tuna catch during the 1988 to 2002 period. Logbook data were available for 845 trips (32% of the fleet's trips) made by the selected vessels during 1988 to 2002. Logbook data for 1988 are only available for the last 6 months of the year (June to December 1988). Also, many vessels remained in port in May, June, and October to December 2000 and again in January and February 2001 to protest the low ex-vessel prices paid by the canneries for fish weighing less than 7.5 pounds.

The logbook data were used to calculate catch rates (catch per day fished, includes days spent searching and deploying rafts, and catch per set) by set type (free-swimming school, FAD or log). Other vessel performance parameters, average number of trips per year, sets per year, sets per day at sea, sets per day fished, number of days with successful sets per day at sea, days fished per day at sea, percent FAD sets, percent free-swimming school sets, and percent log sets were also calculated. Length-frequency data and species composition data were available for 1988 to 2001 (2002 not available) and were used to assess the amounts of bigeye tuna and fish less than 7.5 lb in the catch.

RESULTS

Results are shown in Figures 3-15 for years 1988 through 2002 and are valuable for examining possible trends in various vessel performance indicators and their high and low values throughout this period. However, since logbook data in 1988 only represent the last six months of the year and results from logbook data in 2000 and 2001 may have been influenced by adverse market conditions, as mentioned in the previous section, caution should be used in interpreting results that include those years. For this study, the following comparisons and discussions are limited to the periods 1989-1995, the period of low FAD use, 1996-2002, the period of high FAD use.

The selected vessels, during 1989-2002, fished an average of 4.5 trips per year (Figure 3). There was a 9% increase in the average number of trips per vessel from 4.3 trips during 1989-1995 to 4.7 trips during 1996-2002. The increase doubles (18%) if data for 2000 and 2003, years where vessels were tied up for portions of the year, are left out. Average number of days at sea per trip decreased 16% (no change if 2000 and 2001 data omitted) from 58 days at sea in 1989-1995 to 50 days at sea in 1996-2002 (Figure 4). The average number of days fished per trip decreased 13% (no change if 2000 and 2001 data omitted) from 45 days fished in 1989-1995 to 39 days fished in 1996-2002 (Figure 5). The percentages of the days at sea that were actually fished increased only 1% (3%, if 2000 and 2002 data omitted) from 76% in 1989-1995 to 77% in 1996-2002 (Figure 6). While a larger increase in days fished per days at sea would be expected, the small increase probably reflects the added days needed to plant rafts. The percentages of the number of days at sea that were successful days (>0.5 metric tons, t, caught, Sakagawa 2000) increased 23% (no change if 2000 and 2001 data omitted) from 34% in 1989-1995 to 42% in 1996-2002 (Figure 7). Therefore, vessels were

[2] Seven other U.S. purse seine vessels operating in the CWPO increased capacity during this period but were not included, as they did not operate continually during 1988-2002 (1200 to 1700, 1200 to 1700, 1200 to 1400, 1200 to 1375, 1100 to 1550, 1200 to 1550, 1050 to 1500 st). Data are from NMFS, Fishery Statistics and Industry Services, Long Beach, California, June 2001.

able to make more trips of shorter duration, spent slightly less time fishing and were more successful as a result of FAD fishing.

The percentages of sets by set type for the selected vessels mirrored the trend of the entire fleet. Free-swimming school sets averaged a high of 94% of the selected vessel's sets in 1991 and decreased to only 6% in 1999 and increased again to 56% in 2002 (Figure 8). Floating object sets (logs and FADs) showed the opposite trend with a sharp increase from 6%, in 1991, to a record high of 94% in 1999, followed by a generally declining trend in floating object sets. The majority of the increase in floating object sets was from the sharp increase in FAD usage that went from approximately 0% of sets in 1991 to 87% in 1999, before dropping to 39% in 2002.

The number of sets made per day fished followed a decreasing trend that started after 1991, a year characterized by a high percentage of free-swimming school sets (Figure 9). The number of sets per day fished decreased 19% (no change if 2000 and 2001 data omitted), from 1.01 in 1989-1995 to 0.82 in 1996-2002, when floating object sets became more common. The number of sets per day fished was more variable between years with high effort on free-swimming schools, such as in 1990-1995, than in years when FAD use was highest, 1997-1999, characterized by a single floating object set per day fished.

Catch rates for the selected vessels very closely followed those for the entire fleet. except in 1999 when the selected vessels out performed the rest of the fleet by 18%. Average catch per day fished increased 8% from 25 t/day fished in 1989-1995 to 27 t/day fished in 1996-2002 (no change if 2000 and 2001 data omitted), with a record high 40 t/day fished in 1999 (Figure 10). Catch per set increased more dramatically (36%) from 25 t/set in 1989-1995 to 34 t/set in the high FAD use period 1996-2002, with a peak of 56 t per set in 1999 (Figure 11). Average floating object catch per set (1989-2002, FAD and log sets) was higher, at approximately 40 t per set, than free-swimming school catch per set, at 22 t per set (Figure 12).

Catches for the selected vessels increased 13% (16% if 2000 and 2001 data omitted) from 3,320 t of tropical tunas per vessel-year in 1989-1995 to 3,758 t of tropical tunas per vessel-year in 1996-2002 (Figure 13). The percentages of bigeye tuna in these catches (2002 data not available) increased 500% (no change if 2000 and 2001 data omitted) from 1% in 1989-1995 to 6% in 1996-2001 (Figure 14). The increased catch of bigeye tunas was also accompanied by a 72% increase (only 59% if 2000 and 2001 data omitted) in the numbers of small tropical tunas (<7.5 pounds) caught, from 46% in 1989-1995 to 79% in 1996-2001 (Figure 15).

DISCUSSION

Catch rates have been affected by the increased U.S. purse seine use of FADs. Catch per day fished does not seem to be affected as much as catch per set. However, each seems to increase in 1996-2002 (high FAD use) over average levels during 1989-1995 (low FAD use). Catch per set and catch per day fished, during periods of low FAD use, averaged 25 t/set and 25 t/day fished respectively. Whereas, catch per set and catch per day fished, during periods of high FAD use, averaged 34 t/set and 27 t/day fished respectively. This is likely a result of higher success ratios of sets on floating objects compared to sets on free-swimming schools that have a higher incidence of zero catch sets (Sakagawa 2000). Improved catches on floating object sets may also have been enhanced by improvements in

electronics for FAD location and assessment. However, these effects are not specifically examined here.

Other vessel performance parameters were also affected by the increased use of FADs. Vessels were able to make more frequent and shorter trips, spent less time fishing, were more successful and made fewer sets. Their total targeted catches increased but the presence of bigeye tunas and small fish (<7.5 pounds) in their catch increased significantly. A significant increase in FAD associated by-catch was also likely though not specifically examined here. Floating object sets have been noted to produce larger amounts, higher incidences and greater variety of fish by-catch than other purse seine set types (Bailey, et al. 1994).

Inclusion of the 2000 and 2001 data, years subjected to adverse market conditions that caused the majority of the U.S. fleet to remain in port during the last two months of 2000 and the first two months of 2001, did little to change the results. The major differences were in annual trips per vessel and the amount of small fish and bigeye tuna in the catch.

Lastly, in 2000 and 2001, the fleet remained in port to protest low prices being paid for small fish. Since most of the fish caught on FADs are smaller fish, when the fleet did fish, during 2000, 2001 and also in 2002, they concentrated on larger, higher value fish (yellowfin and larger skipjack tunas) taken from free-swimming schools. The result of this switch was that many of the performance parameters examined here, especially catch per day fished and catch per set, returned to levels experienced during past periods with reduced FAD use. This would again support the premise that FAD fishing has affected catch rates. However, since it is uncertain how fishing in those months when the fleet was in port would have affected these results, caution should be exercised in interpreting the results in 2000 and 2001.

LITERATURE CITED

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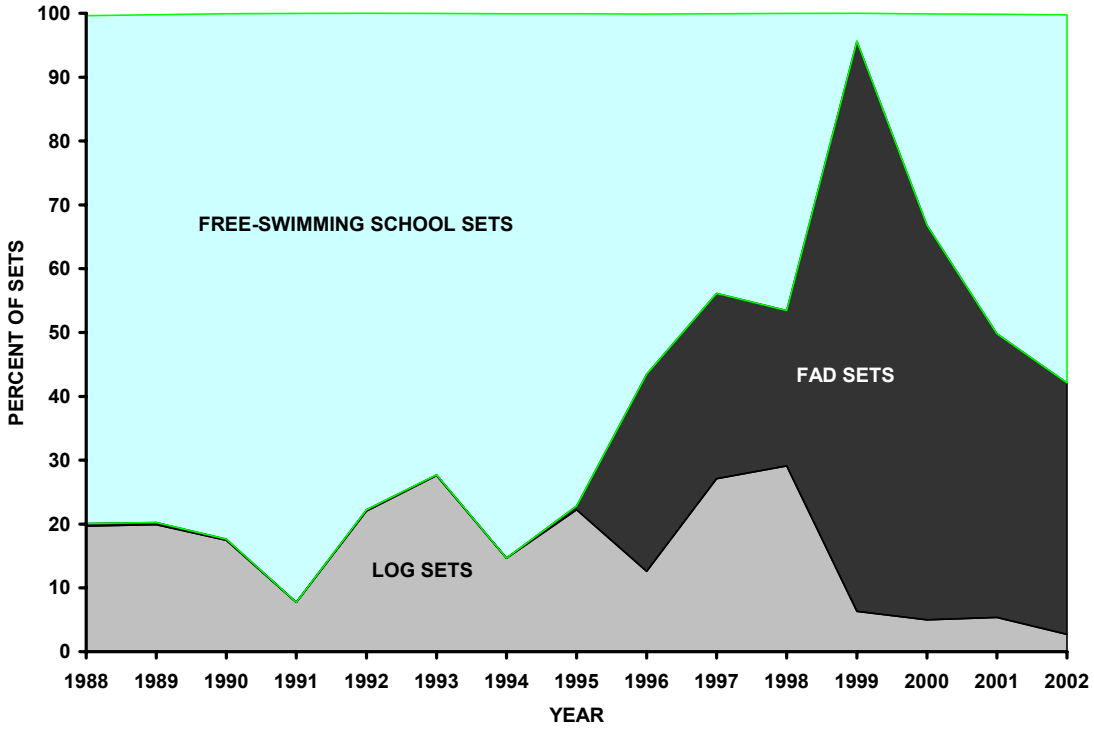

Figure 1. Percent of purse seine sets by set type, free-swimming school, log and Fish Aggregation Devices (FAD) for the entire U.S. purse seine fleet fishing in the central-western Pacific Ocean.

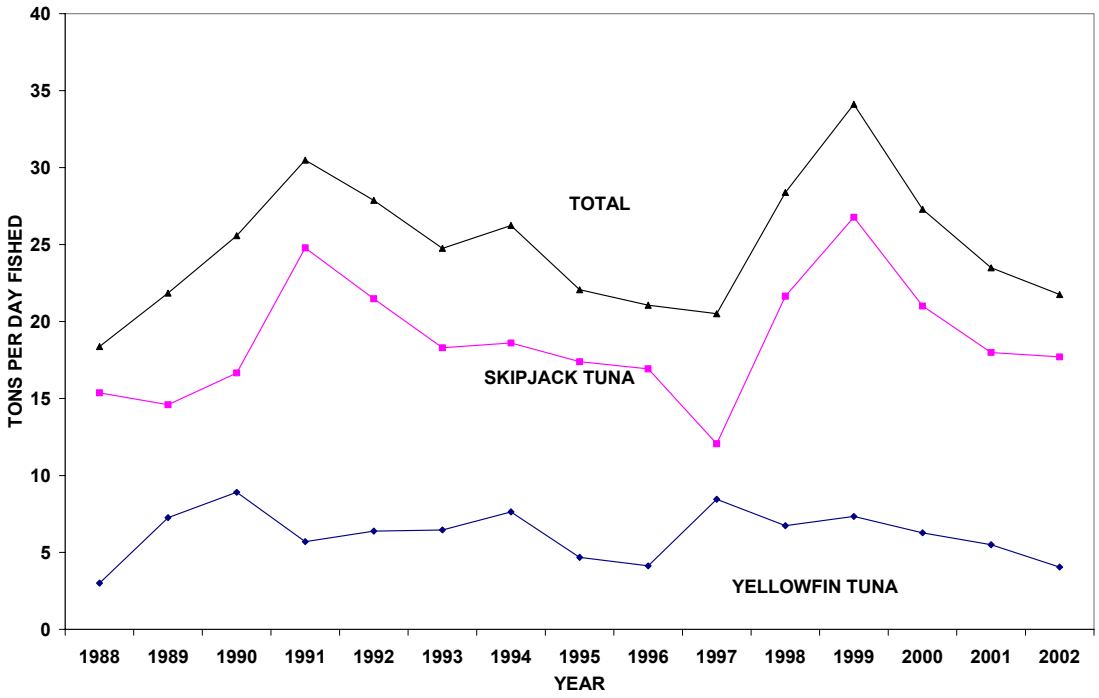

Figure 2. Catch rates in tons per day fished for the entire U.S. purse seine fleet in the central-western Pacific Ocean.

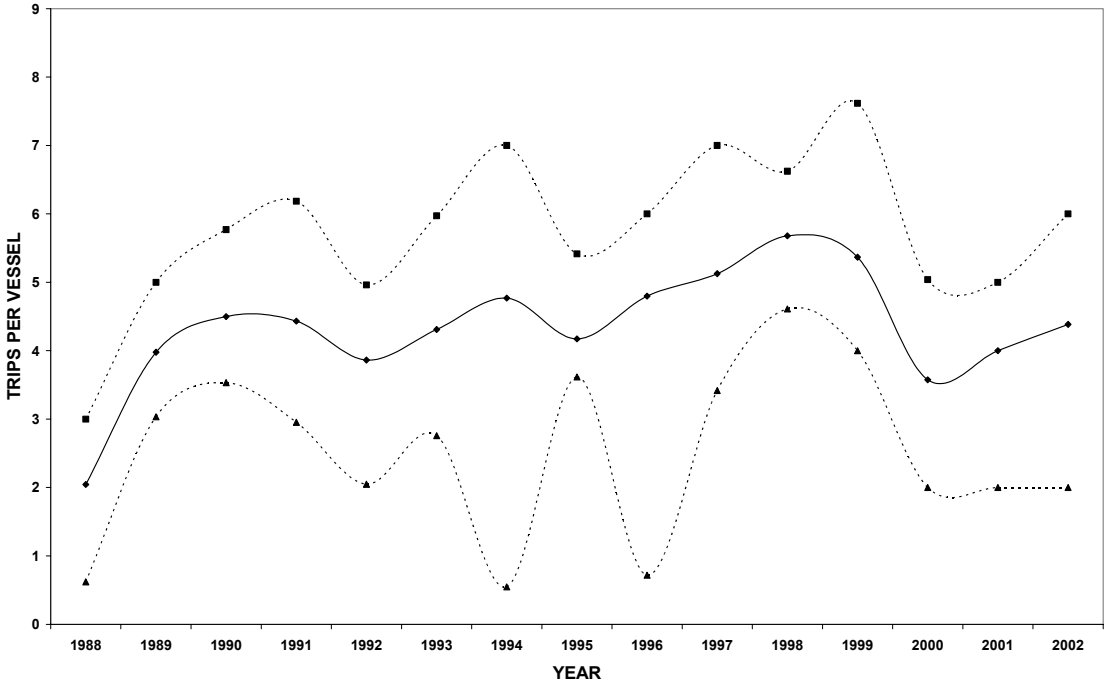

Figure 3. Average number of trips per vessel for 13 U.S. purse seiners fishing in the central-western Pacific, 1988-2002. Dotted lines indicate the range.

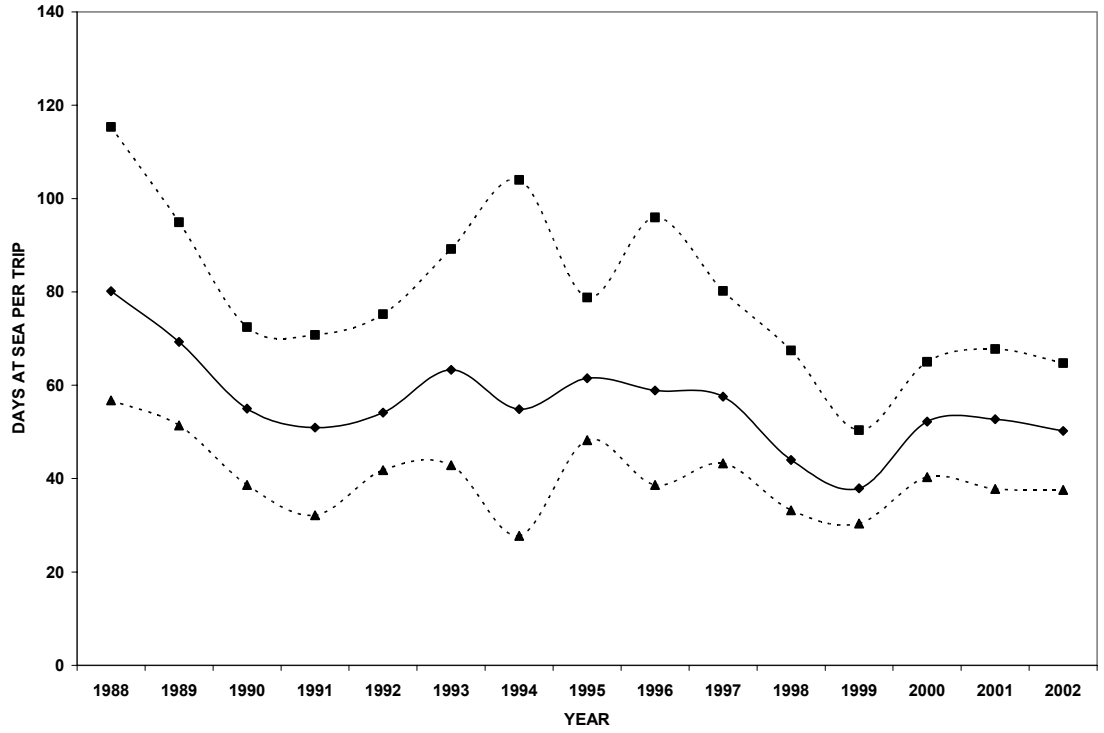

Figure 4. Average number of days at sea per trip for 13 U.S. purse seiners fishing in the central-western Pacific, 1988-2002. Dotted lines indicate the range.

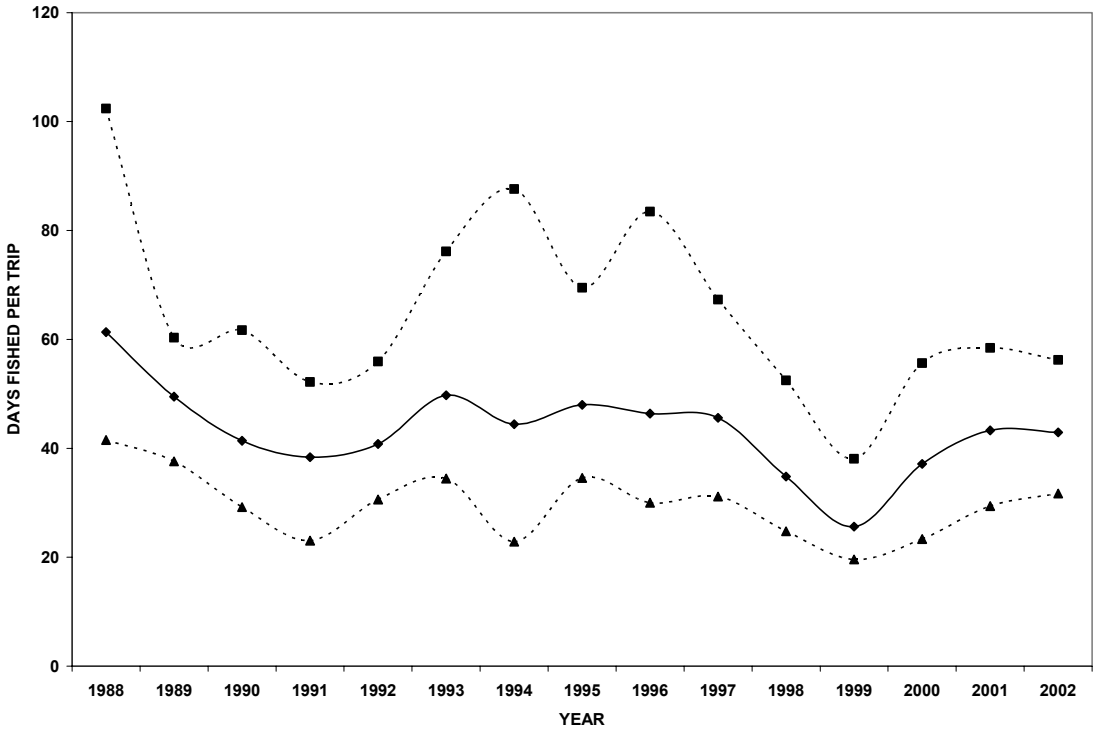

Figure 5. Average number of days fished per trip for 13 U.S. purse seiners fishing in the central-western Pacific during 1988-2002. Dotted lines indicate the range.

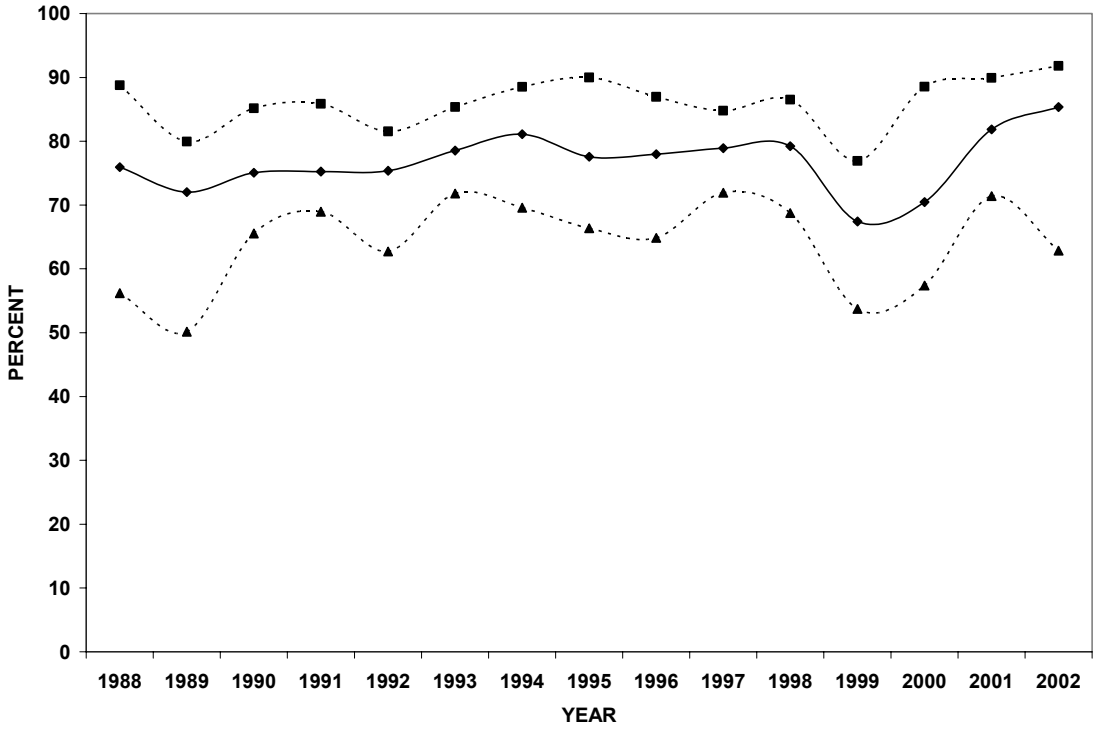

Figure 6. Average percentage of days at sea actually fished for 13 U.S. purse seiners fishing in the central-western Pacific, 1988-2002. Dotted lines indicate the range.

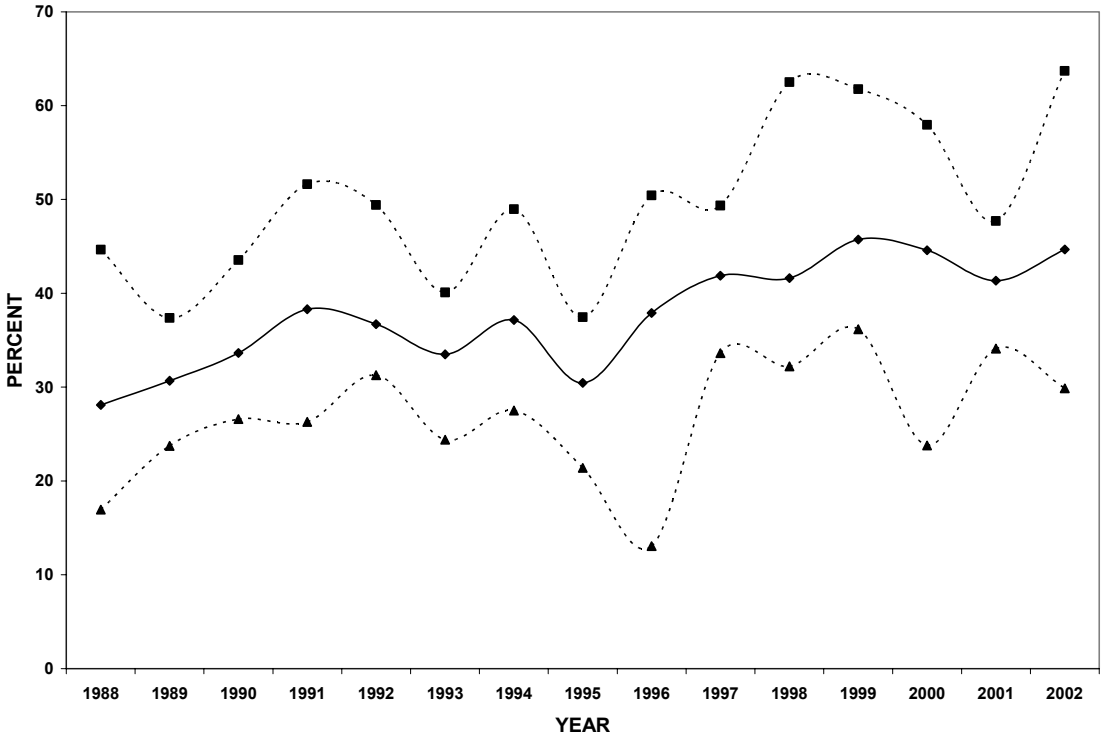

Figure 7. Average percentage of days at sea that was successful days (catch >0.5 t) for 13 U.S. purse seiners fishing in the central-western Pacific, 1988-2002. Dotted lines indicate the range.

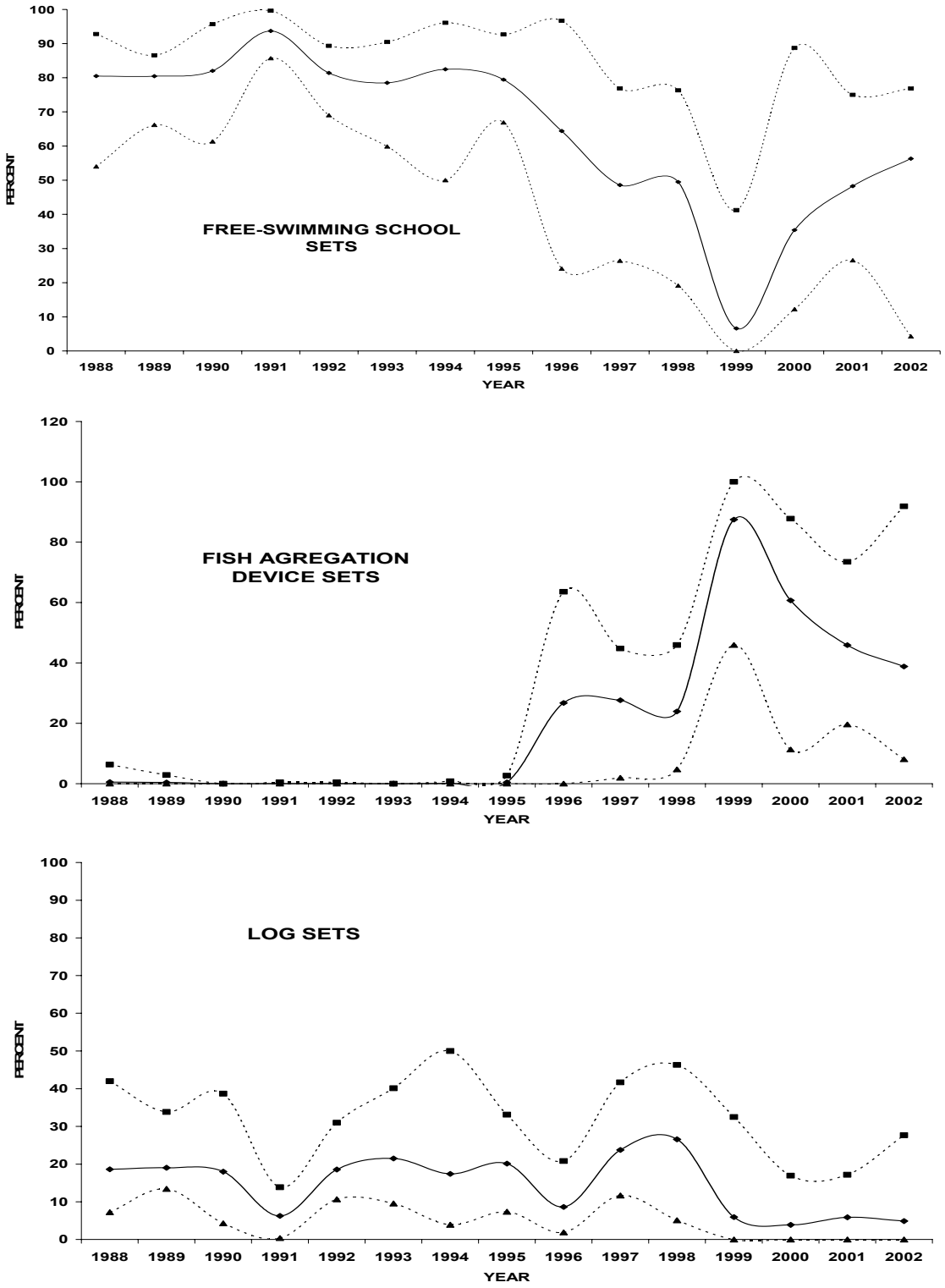

Figure 8. Average percentage of sets, by set type, for 13 U.S. purse seiners fishing in the central-western Pacific, 1988-2002. Dotted lines indicate the range

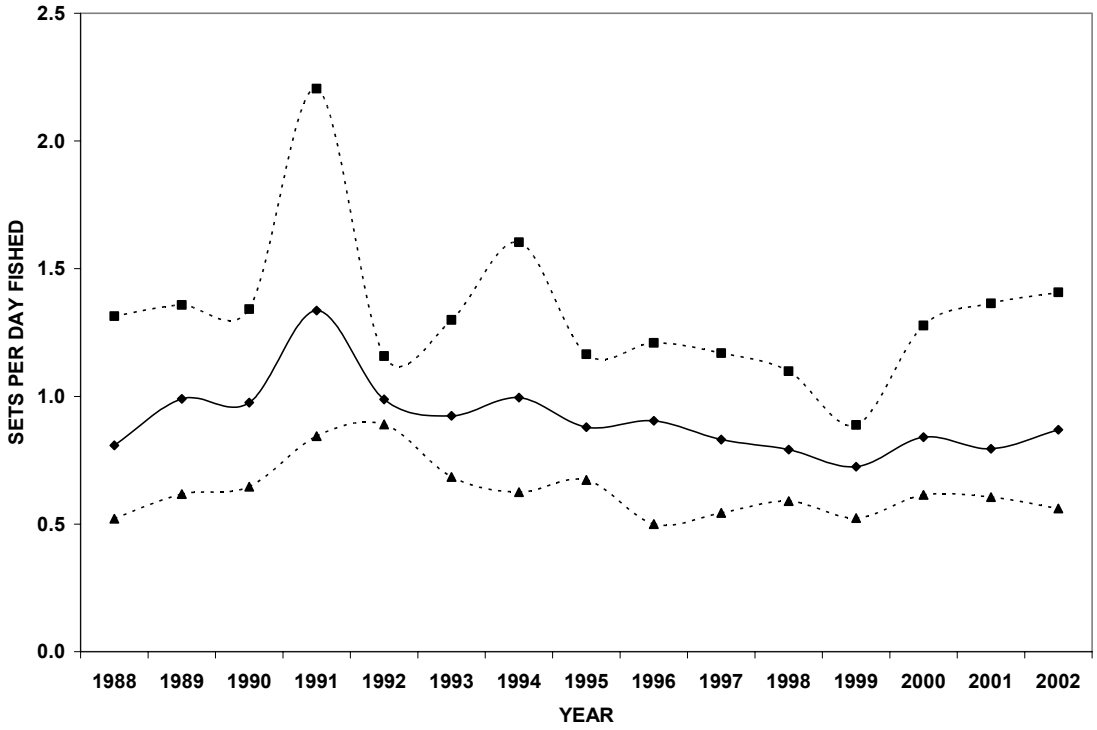

Figure 9. Average number of sets per day fished for 13 U.S. purse seiners fishing in the central-western Pacific, 1988-2002. Dotted lines indicate the range.

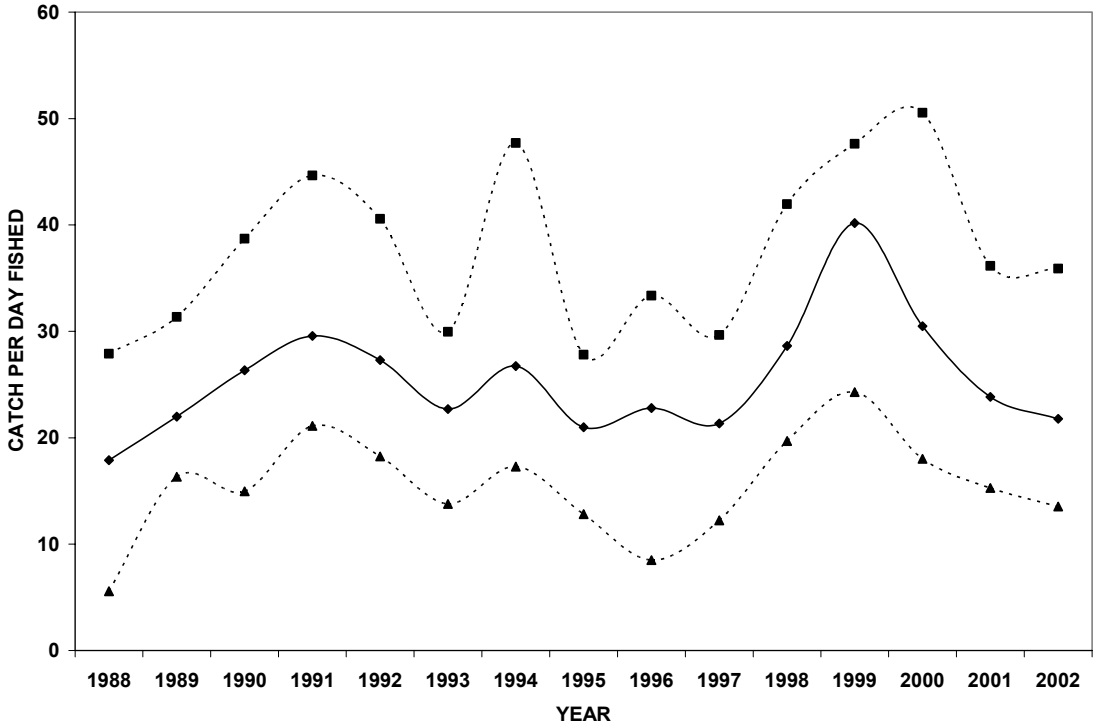

Figure 10. Average catch (t) per day fished for 13 U.S. purse seiners fishing in the central-western Pacific, 1988-2002. Dotted lines indicate the range.

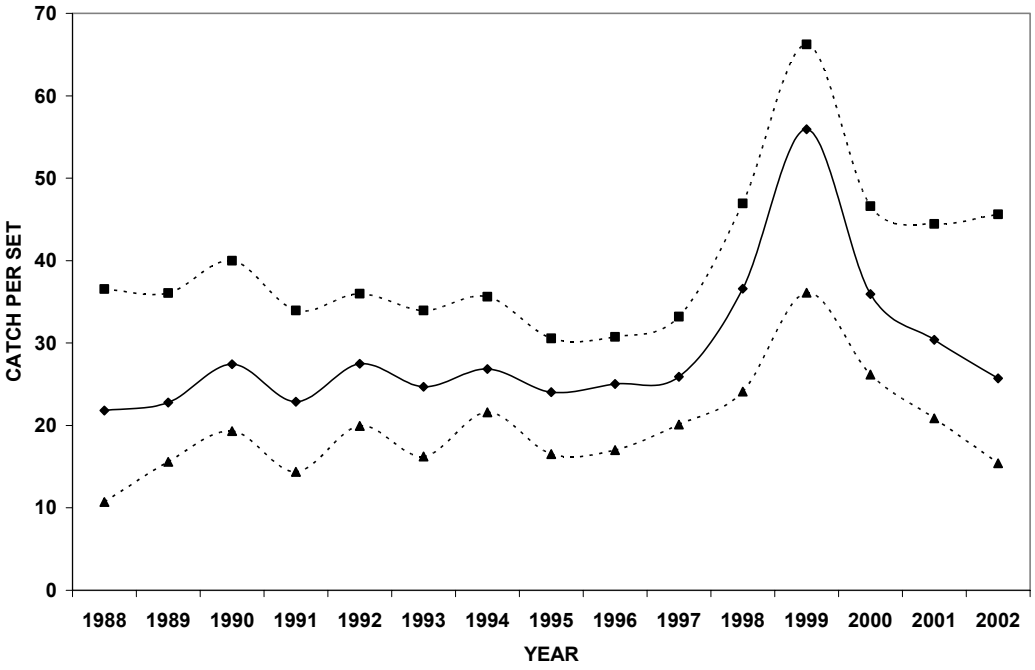

Figure 11. Average catch (t) per set for 13 U.S. purse seiners fishing in the central-western Pacific, 1988-2002. Dotted lines indicate the range.

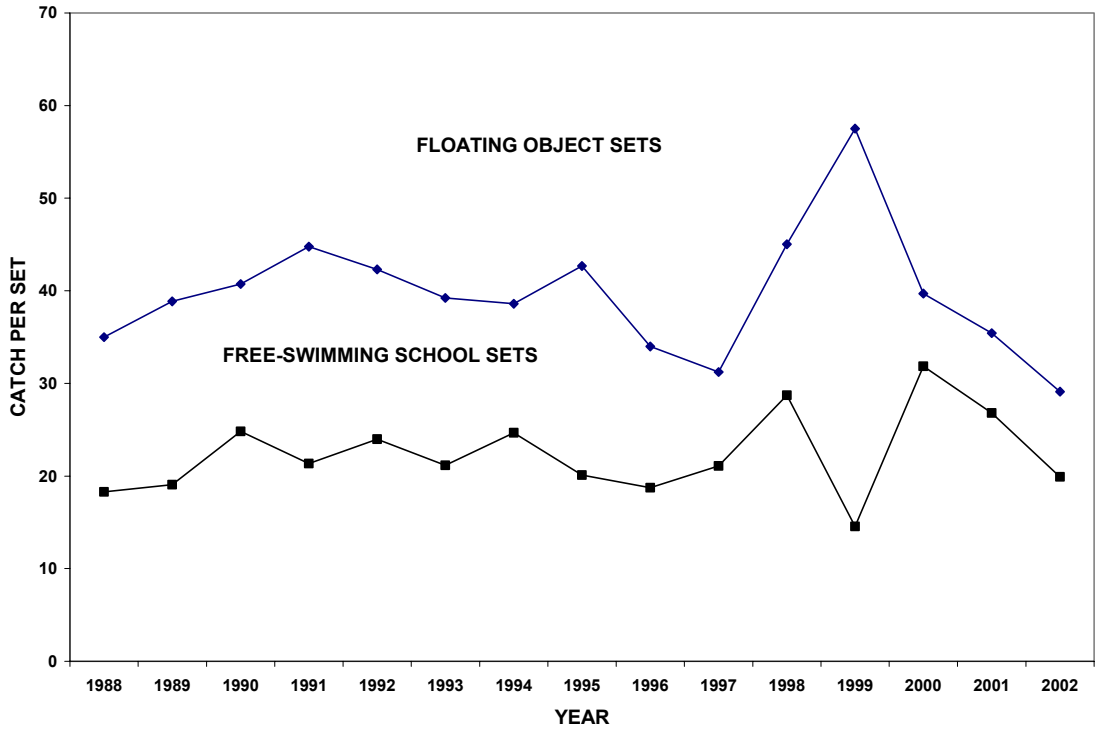

Figure 12. Average catch (t) per set in floating object (fish aggregation devices and logs) and free-swimming school sets for 13 U.S. purse seiners fishing in the central-western Pacific, 1988-2002.

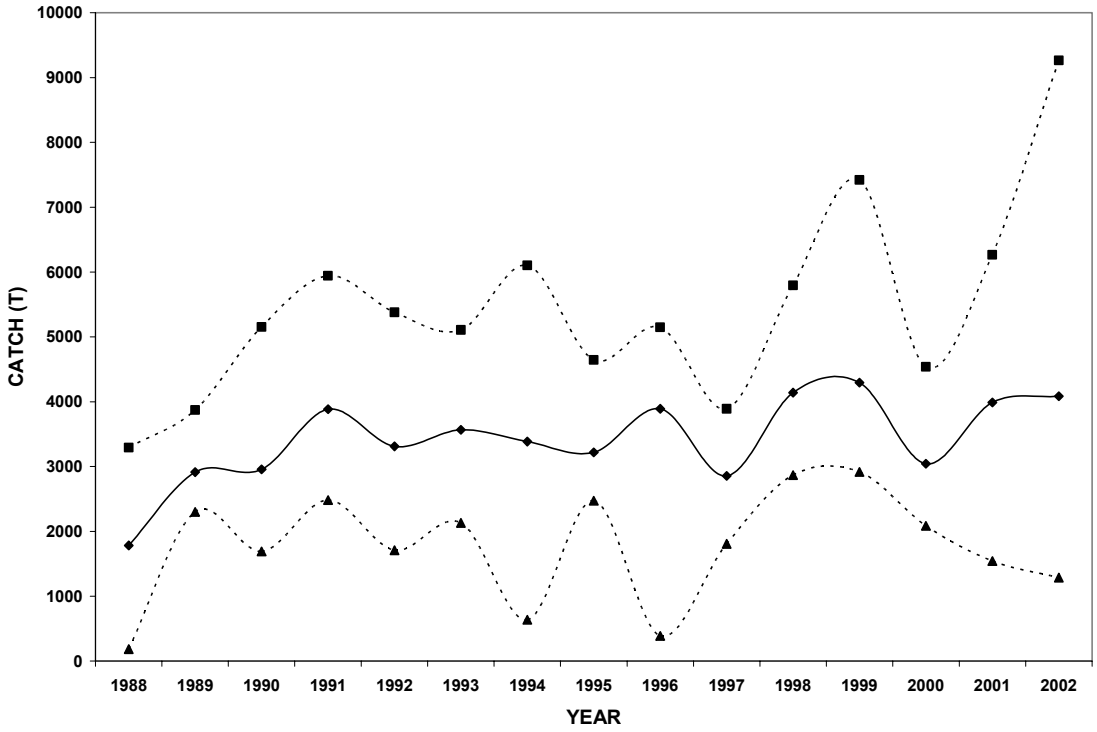

Figure 13. Average total catch of 13 U.S. purse seiners fishing in the central-western Pacific, 1988-2002. Dotted lines indicate the range.

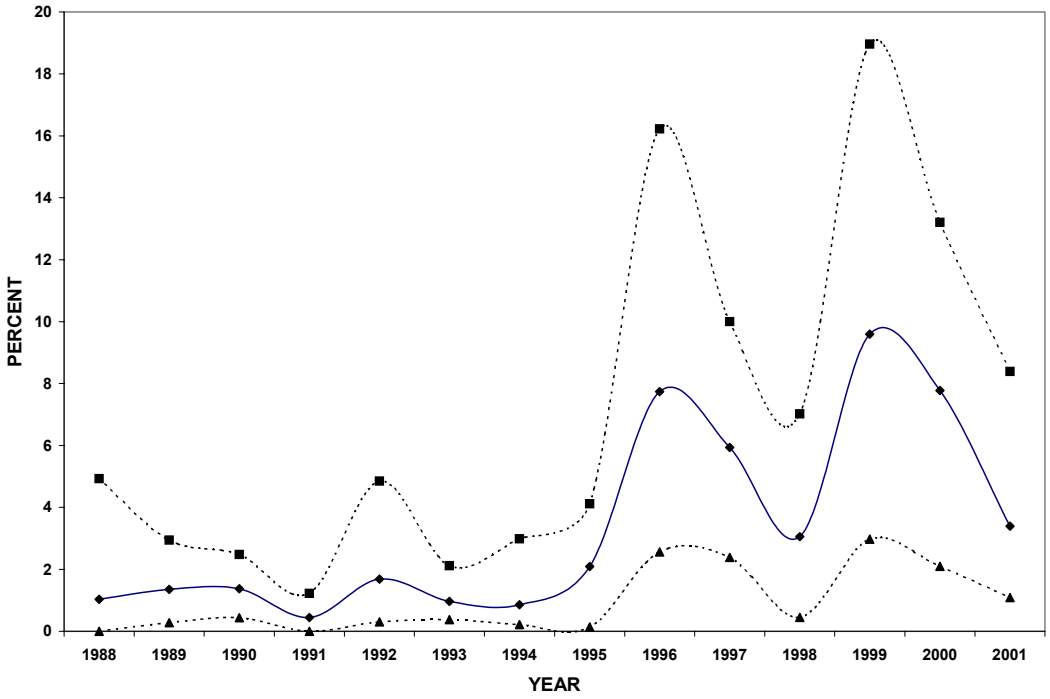

Figure 14. Average percent bigeye tuna in the total catch of 12 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific, 1988-2001 (2002 data unavailable). Dotted lines indicate the range.

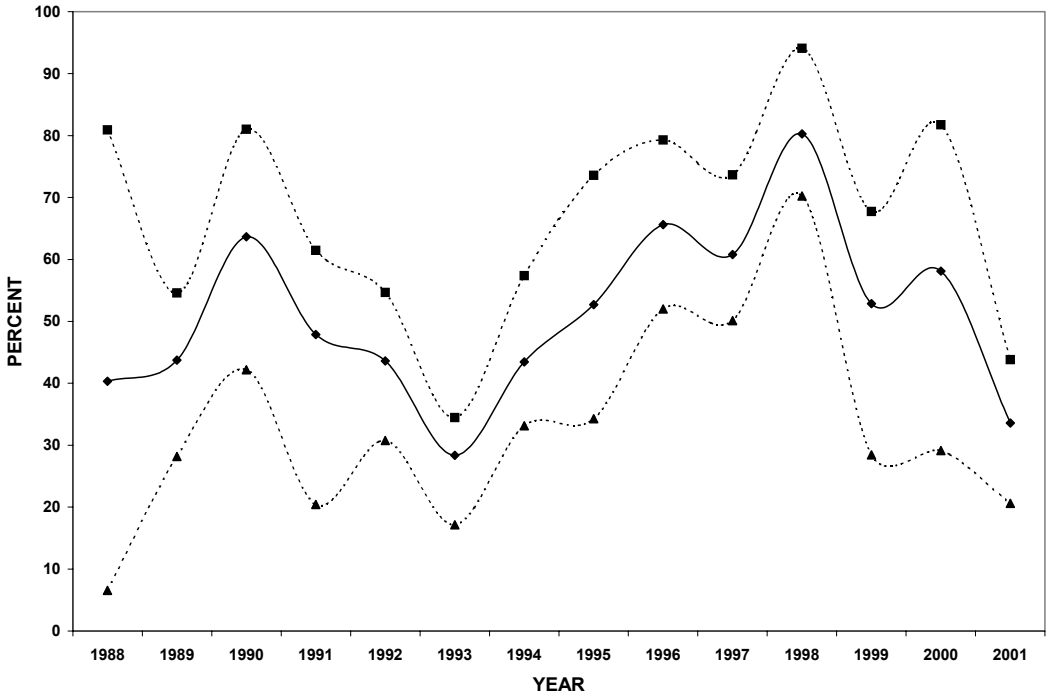

Figure 15. Average percent in number of small fish (<7.5 pounds) in the total catch of 12 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific, 1988-2001 (2002 data unavailable). Dotted lines indicate the range.