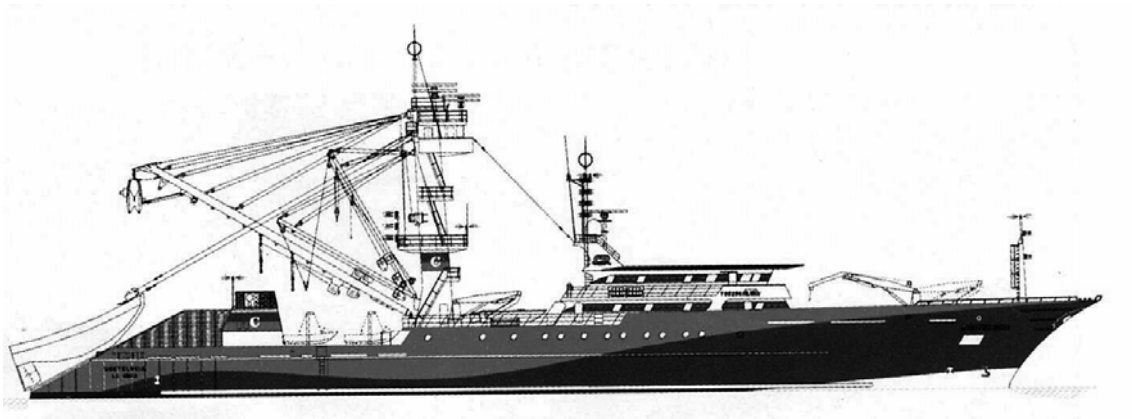
SCTB15 Working Paper

FTWG–2

An update 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[1]



Atilio L. Coan Jr.[2]

and

David G. Itano[3]

[1] Report prepared for the 15th Standing Committee on Tunas and Billfishes, Fishing Technology Working Group, July 18-27, 2002, Honolulu, Hawaii

[2] National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, California, U.S.A.

[3] University of Hawaii, Pelagic Fisheries Research Program, Honolulu, HI 96822

An update 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

Atilio L. Coan Jr.

National Marine Fisheries Service
Southwest Fisheries Science Center
La Jolla, CA 92038

David G. Itano

University of Hawaii
Pelagic Fisheries Research Program
Honolulu, HI 96822

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 with drifting Fish Aggregation Devices (FADs). Changes brought about by the shift to a 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 a previous study submitted to the Fishing Technology Working Group at the 14th meeting of the Standing committee of Tunas and Billfish by adding data for 2001. Landings, logbook, vessel specification and length and species composition sampling data from a portion of the U.S. fleet that fished continually during the 1988 to 2001 period are examined and changes in catch rates and other vessel performance indicators caused by the fleet's shift to FAD fishing are documented.

DATA

Landing records for all CWPO-based U.S. purse seiners were reviewed and vessels that fished continually during the 1988 to 2000 period were selected. Fifteen vessels (selected vessels) met this criterion and of these only 14 continued to operate in 2001 (one vessel changed flag and fishing area). Of the selected vessels operating in 1988 to 2001, only two increased fishing capacity in 2000 (1,200 short tons (st) to 1,850 st and 1,200 st to 2,000

st[4]). The average fishing capacity of the 15 selected vessels during the 1988-2000 period was 1,250 st. Addition of the average capacity of the 14 vessels fishing in 2001 (1,240 st), changed the 1988 to 2000 average capacity only slightly to 1,249 st.

The 15 selected vessels represent 38% of the U.S. fleet (numbers of vessels) and 39% of the fleet's tuna catch during the 1988 to 2000 period. Extending the period to 2001 changed the amount of the tuna catch represented slightly to 40%, but had no effect on the percent of the fleet represented. Logbook data were available for 857 trips (36% of the fleet's trips) made by the selected vessels during 1988 to 2000. Fifty-five additional trips (47% of the fleet's trips) were made in 2001. 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. Of the 15 selected vessels during 1988-2000, 12 were sampled for species composition and length-frequency. In 2001, all 14 were sampled.

The 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, percent log sets, percentage of bigeye tuna in the total catch and percent of fish <7.5 pounds in the total catch were also calculated.

RESULTS

Results are shown in Figures 3-15 for 1988, 2000 and 2001 and are valuable for possible trends in those years. 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, the following comparisons and discussions are limited to the periods 1989-1995, the period of low FAD use, and 1996-1999, the period of high FAD use.

The selected vessels, during the 1989-1999 period, fished an average of 5 trips per year (Figure 3). There was an 18% increase in the average number of trips per vessel from 4.4 trips during 1989-1995 to 5.2 trips during 1996-1999. The average number of days at sea per trip decreased 11% from 56 days at sea in 1989-1995 to 50 days at sea in 1996-1999 (Figure 4). The average number of days fished per trip decreased 12% from 43 days fished in 1989-1995 to 38 days fished in 1996-1999 (Figure 5). The percentages of the days at sea that were actually fished increased only 0.4% from 75.74% in 1989-1995 to 76.16% in 1996-1999 (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 6% from 35% in 1989-1995 to 41% in 1996-1999 (Figure 7). Therefore, vessels were able to make more trips of shorter duration, spent slightly less time fishing and were more successful as a result of FAD fishing.

[4] 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 1988-2000 (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.

The percentages of sets by set type of 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 (Figure 8). Floating object sets showed the opposite trend with a sharp increase from 6%, in 1991, to a high of 94% in 1999. 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 89% in 1999.

The number of sets made per day fished followed a decreasing trend that started in 1991 (Figure 9). The number of sets per day fished decreased 28% from 1.03 in 1989-1995 to 0.74 in 1996-1999. The number of sets per day fished was more variable between years with high effort on free-swimming schools, such as in 1990-1992, than in years when FAD use was highest, 1997-1999.

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 15%. Average catch per day fished increased 8% from 26 t/day fished in 1989-1995 to 28 t/day fished in 1996-1999, with a record high 39 t/day fished in 1999 (Figure 10). Catch per set increased more dramatically by 84% from 25 t/set in 1989-1995 to 46 t/set in 1996-1999, with a peak of 55 t per set in 1999 (Figure 11). Average catch per set (1989-1999) from floating object sets (FAD and log sets) was the highest at approximately 42 t per set, followed by free-swimming school sets at 23 t per set (Figure 12).

Catches for the selected vessels increased 11% from 4,500 t of tropical tunas per vessel-year in 1989-1995 to 5,000 t of tropical tunas per vessel-year in 1996-1999 (Figure 13). The percentages of bigeye tuna in these catches increased 500% from 1.25% in 1989-1995 to 6.25% in 1996-1999 (Figure 14). The increased catch of bigeye tunas was also accompanied by a 33% increase in the numbers of small tropical tunas (<7.5 pounds) caught, from 46% in 1989-1995 to 79% in 1996-1999 (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 1996-1999 (high FAD use) over average levels during 1989-1995 (low FAD use). For the selected vessels, catch per set and catch per day fished averaged 25 t/set and 26 t/day fished respectively during periods of low FAD use. Catch per set and catch per day fished increased to average 46 t/set and 28 t/day fished respectively during periods of high FAD use.

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.

Lastly, while 2000 and 2001 data were not compared due to adverse market conditions in those years that caused the majority of the fleet to remain in port during the last two months of 2000 and the first two months of 2001, the data can be used to speculate what

would have happen to catch rates if the fleet reduced their FAD use. The fleet remained in port to protest low prices being paid for fish less than 7.5 lbs. Since most of the fish caught on FADs are smaller fish, when the fleet did fish, during 2000 and 2001, they concentrated on larger, higher value fish 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

Sakagawa, G. T. 2000. The impact of FAD innovation on the performance of U.S. tuna purse seine operations in the Pacific Ocean. pp. 371-388. *In*: Jean-Yves Le Gall, Patrice Cayré, and Marc Taquet (eds). Pêche thonière et dispostifs de concentration de poissons, October 15-19, 1999, Trois-Îlets, Martinique. Actes de colloques n°28 - 2000. Institut français de recherche pour l'exploitation de la mer (Ifremer), Plouzané, France.

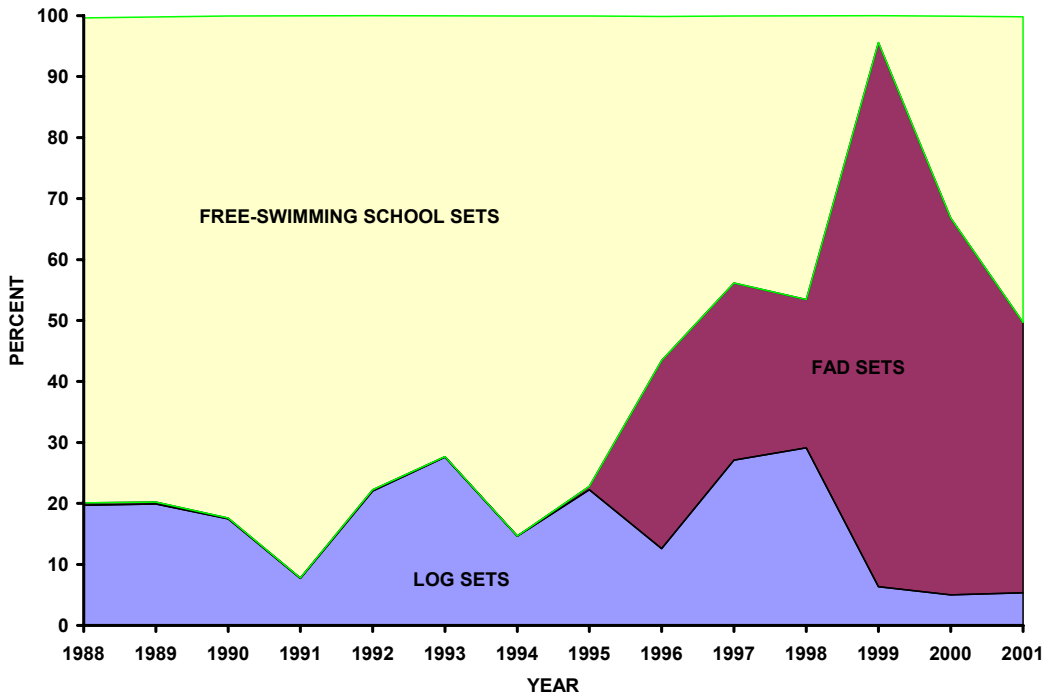


Figure 1. Percent of purse seine sets by set type, free-swimming school, log and Fish Aggregation Devices (FAD) for the entire U.S. purse seine fleet fishing in the central-western Pacific Ocean.

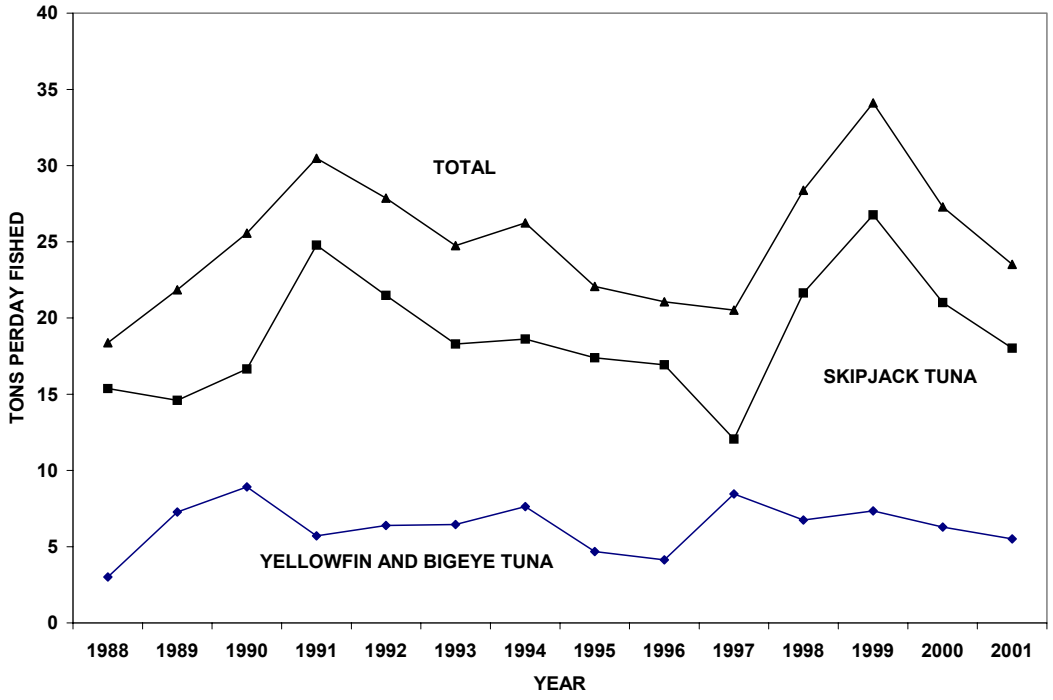


Figure 2. Catch rates in tons per day fished for the entire U.S. purse seine fleet in the central-western Pacific Ocean.

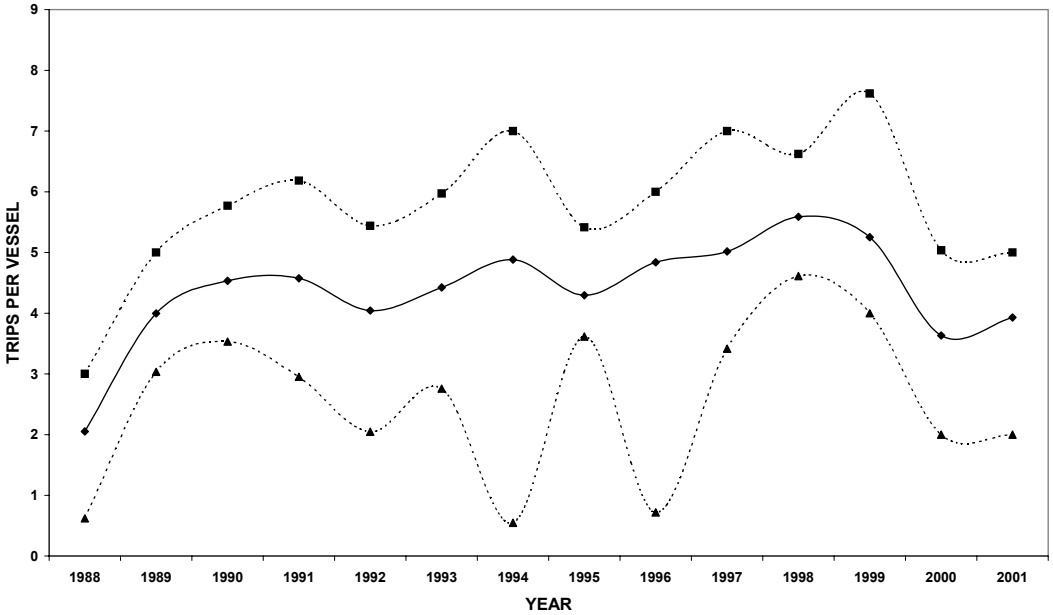


Figure 3. Average number of trips per vessel for 15 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific, 1988-2001. Dotted lines indicate the range.

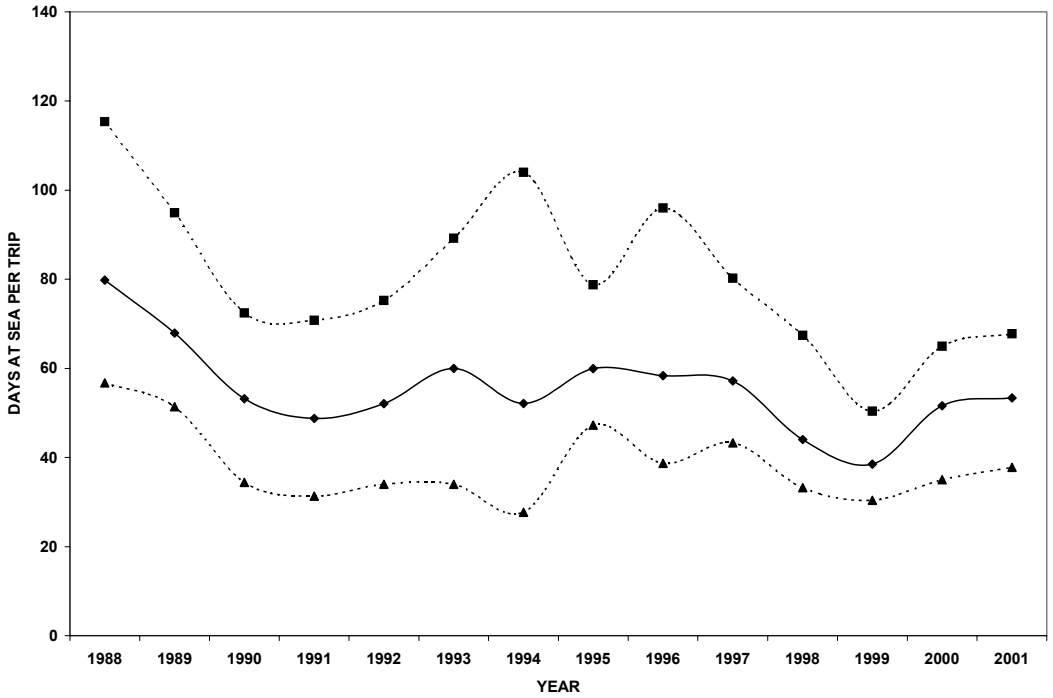


Figure 4. Average number of days at sea per trip for 15 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific, 1988-2001. Dotted lines indicate the range.

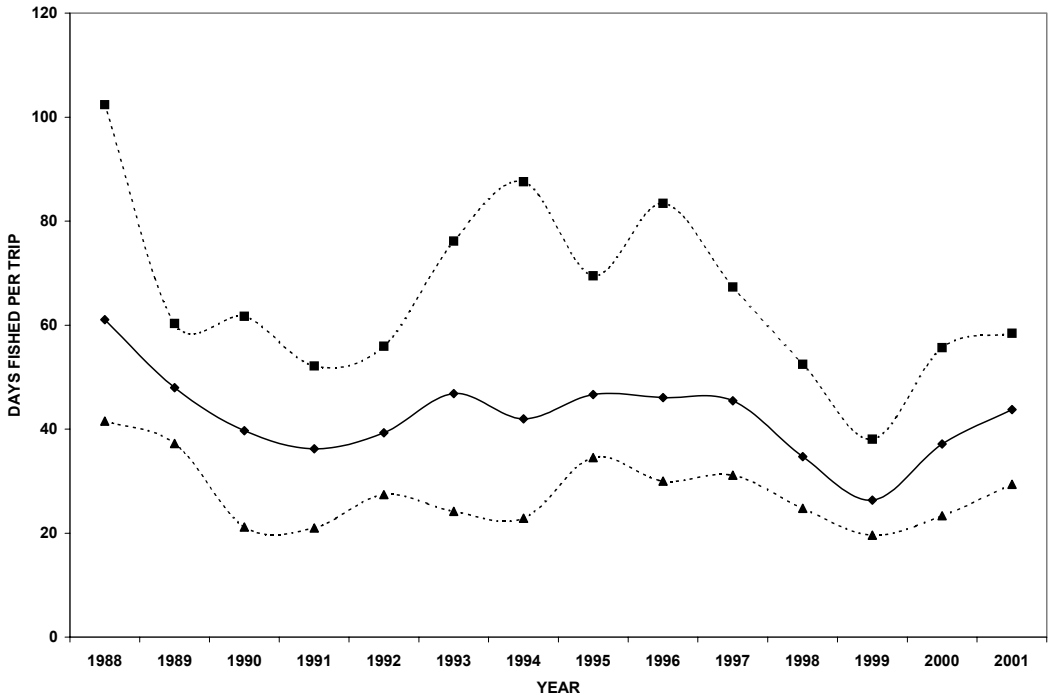


Figure 5. Average number of days fished per trip for 15 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific during the 1988-2001 period. Dotted lines indicate the range.

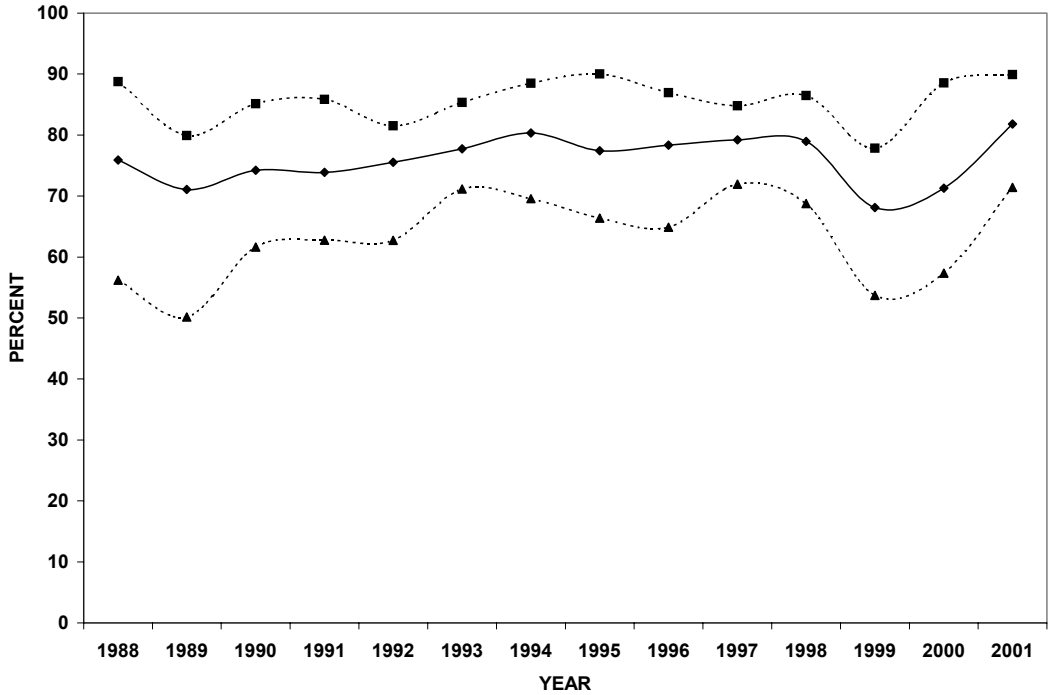


Figure 6. Average percentage of days at sea actually fished for 15 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific, 1988-2001. Dotted lines indicate the range.

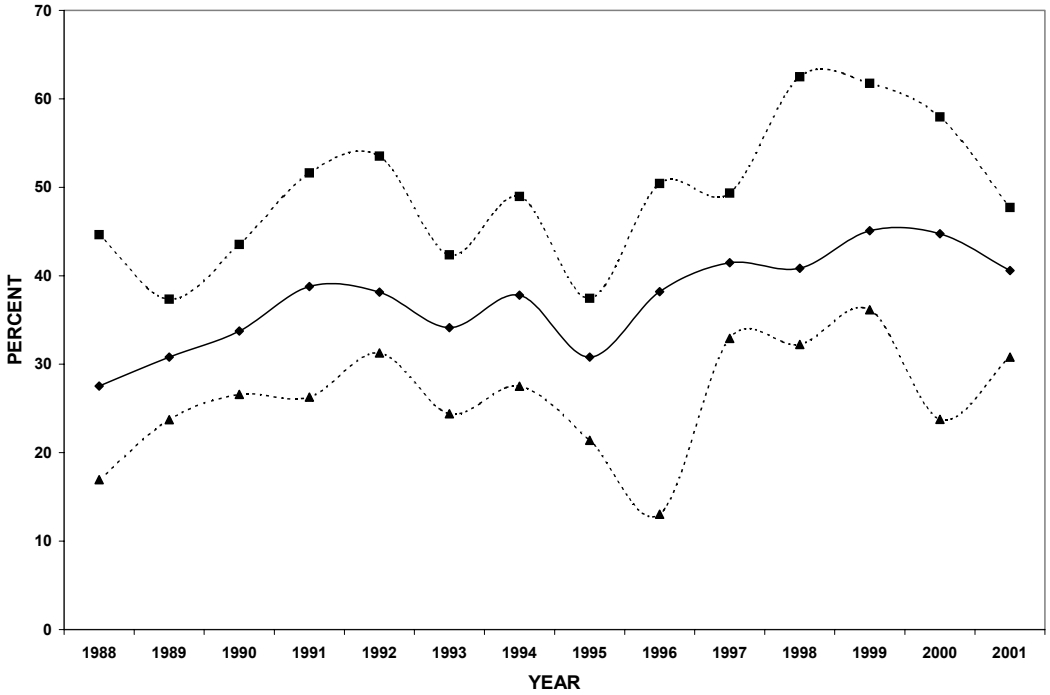


Figure 7. Average percentage of days at sea that was successful days (catch >0.5 t) for 15 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific, 1988-2001. Dotted lines indicate the range.

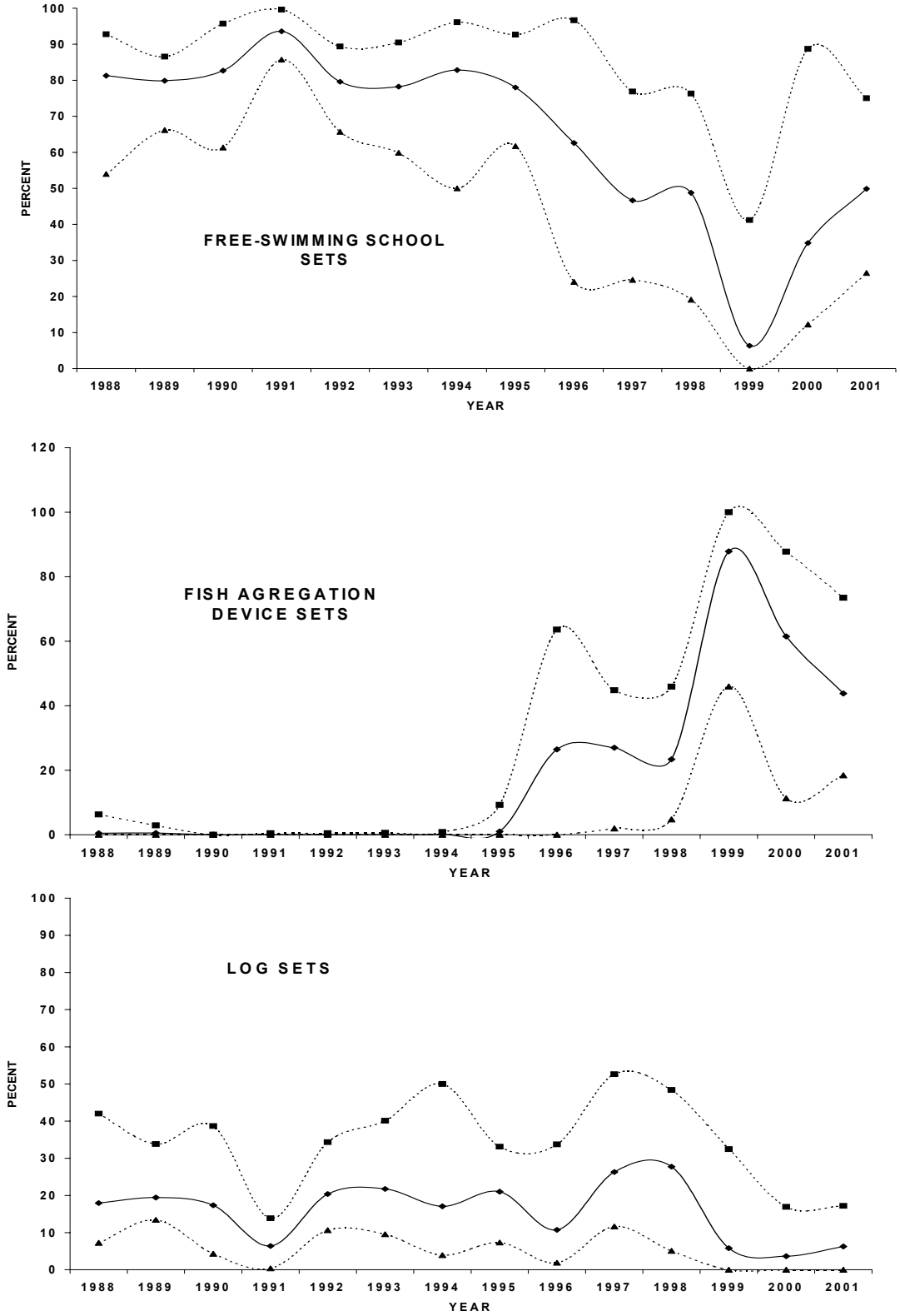


Figure 8. Average, percentage of sets by set type for 15 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific, 1988-2001. Dotted lines indicate the range

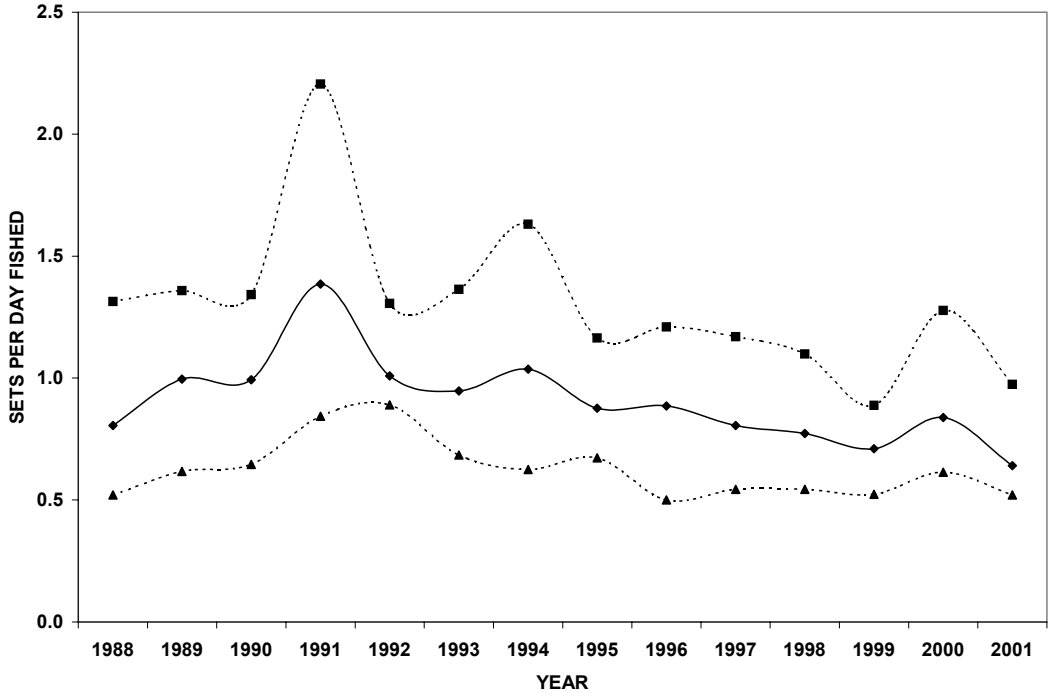


Figure 9. Average number of sets per day fished for 15 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific, 1988-2001. Dotted lines indicate the range.

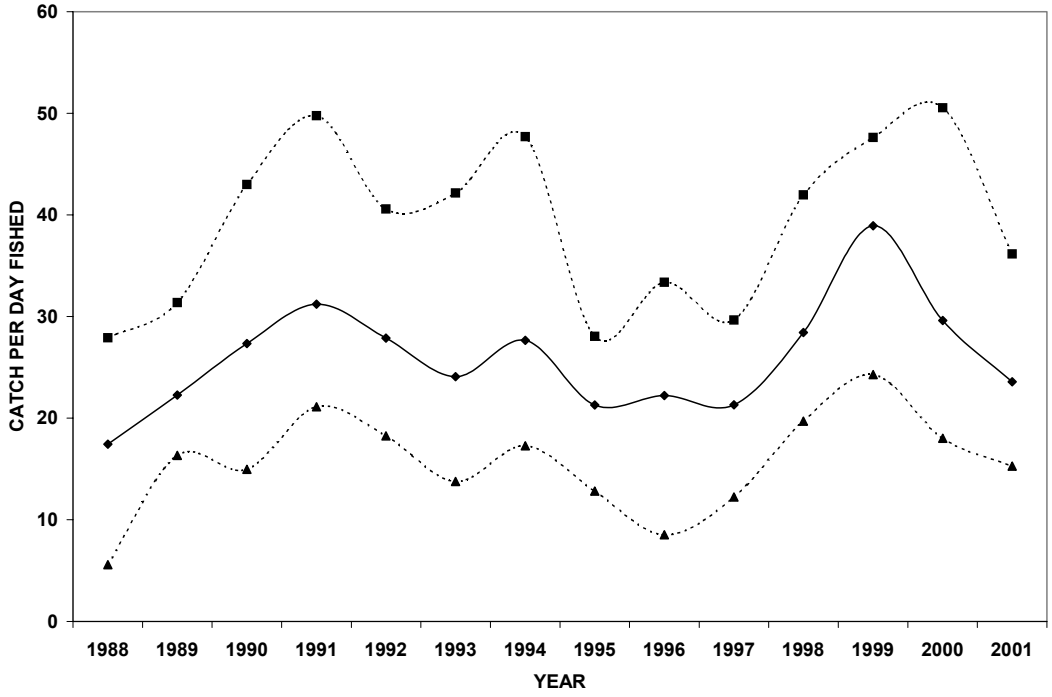


Figure 10. Average catch (t) per day fished for 15 U.S. purse seiners (14 in2001) fishing in the central-western Pacific, 1988-2001. Dotted lines indicate the range.

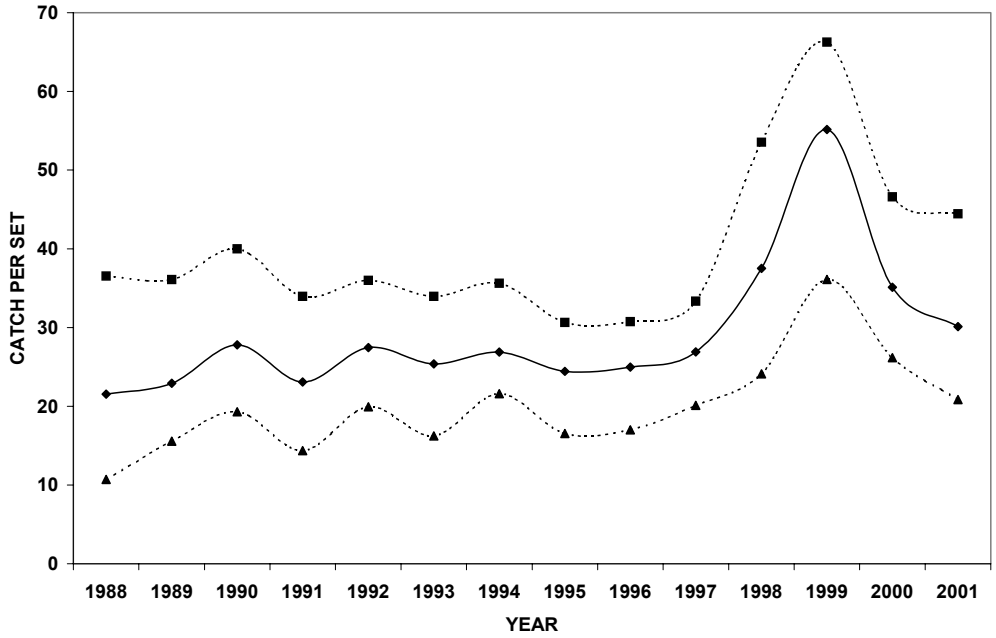


Figure 11. Average catch (t) per set for 15 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific, 1988-2001. Dotted lines indicate the range.

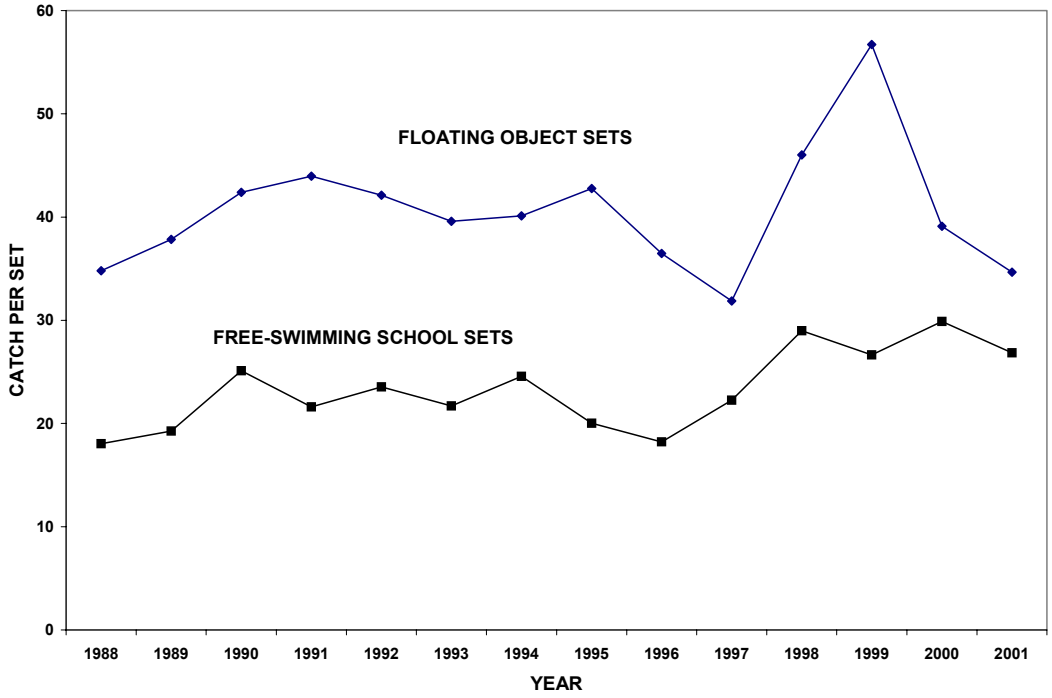


Figure 12. Average catch (t) per set in floating object (fish aggregation devices and logs) and free-swimming school sets for 15 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific, 1988-2001.

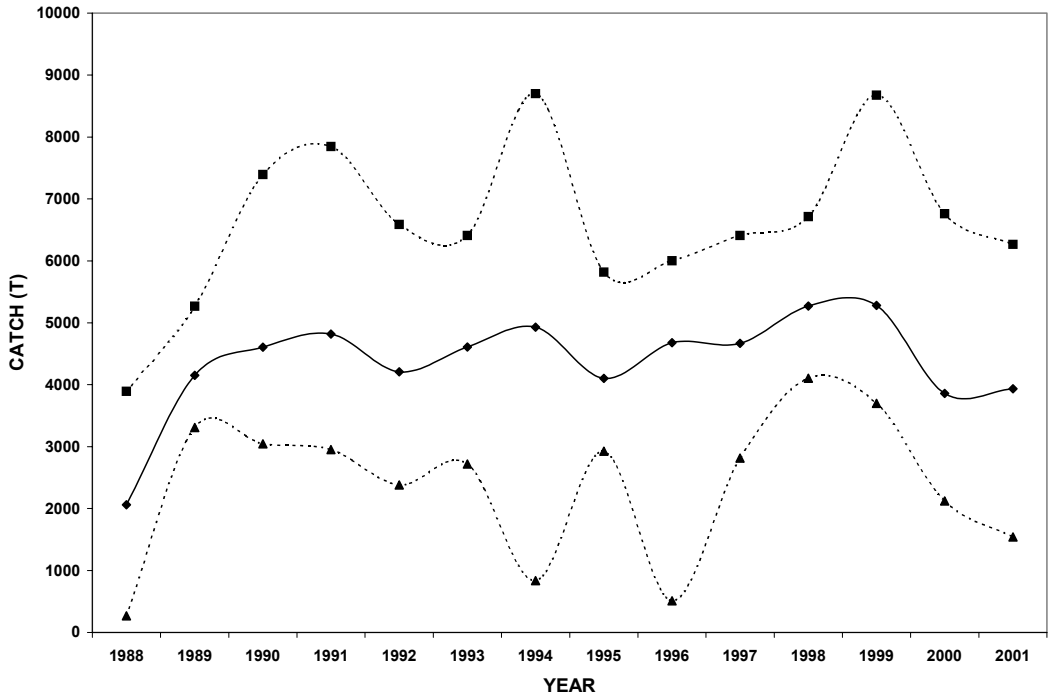


Figure 13. Average total catch of 15 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific, 1988-2001. Dotted lines indicate the range.

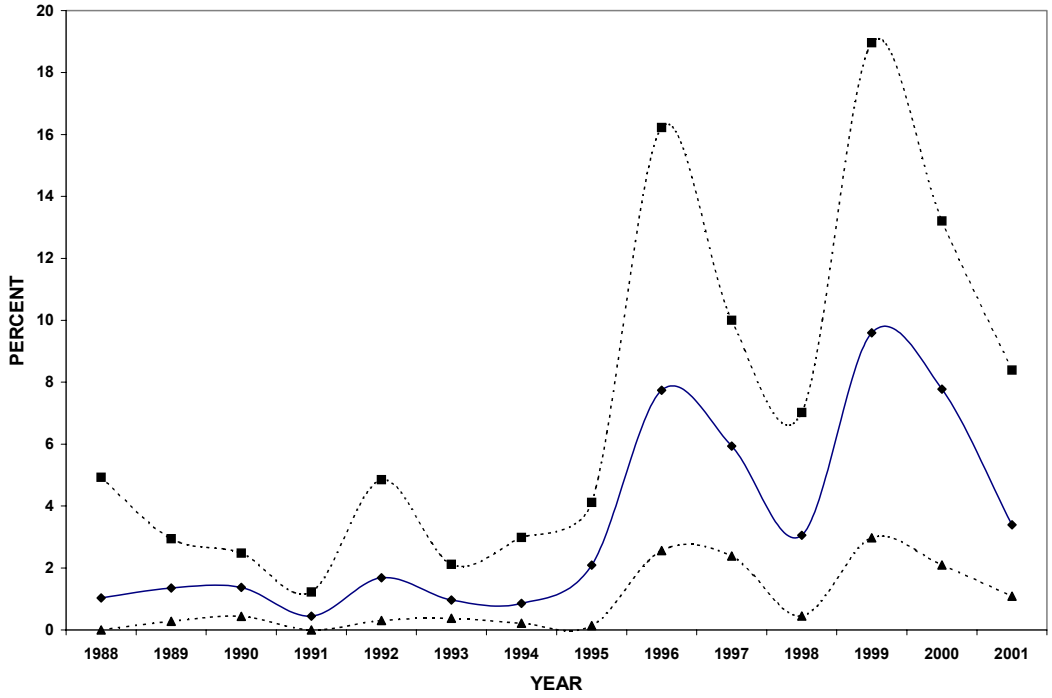


Figure 14. Average percent bigeye tuna in the total catch of 12 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific, 1988-2001. Dotted lines indicate the range.

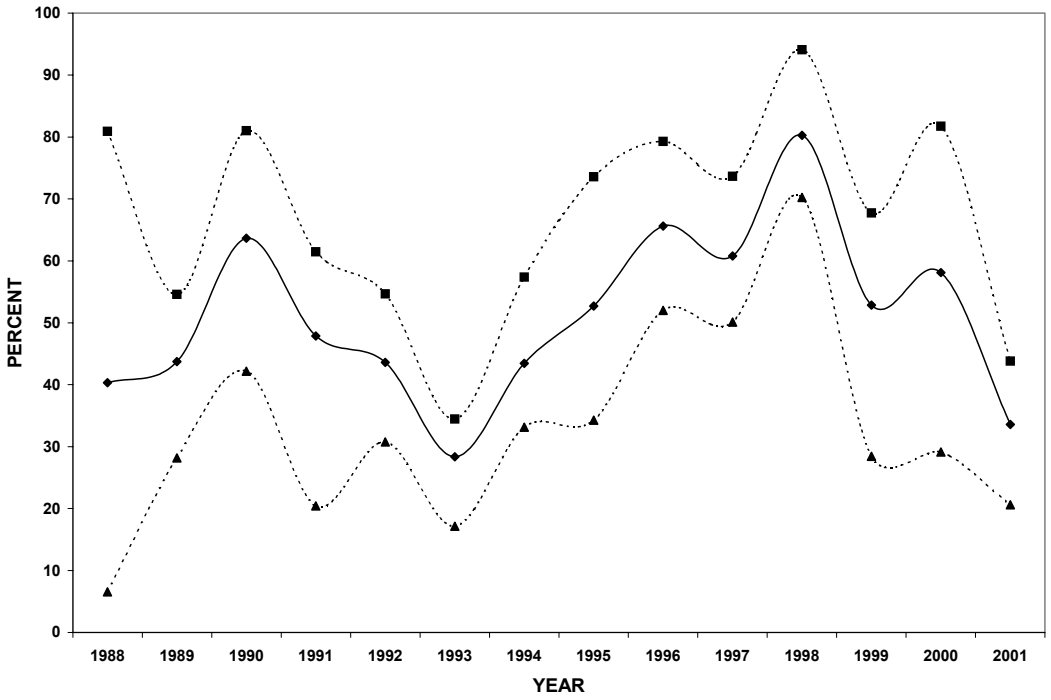


Figure 15. Average percent in number of small fish (<7.5 pounds) in the total catch of 12 U.S. purse seiners (14 in 2001) fishing in the central-western Pacific, 1988-2001. Dotted lines indicate the range.