Estimated Discard and Discard Rates in the Coastal Washington Arrowtooth Flounder Fishery In 2001

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Table of Contents

Executive Summary

Overview

In 2001, WDFW began a 2-year cooperative industry at-sea data collection program in an effort to facilitate directed Arrowtooth flounder fishing and to establish an objective basis for estimation of canary rockfish discard in that fishery. The program was approved by the Pacific Fishery Management Council (PFMC) and National Marine Fisheries Service (NMFS) and administered under an Exempted Fishing Permit. This report provides a review of the 2001 (year 1) observer data and an estimate of discarded catch for the participating vessels. A final report will be produced in 2003 summarizing results of the entire program.

All participating vessels were required to carried observers throughout the study period and retain all rockfish species (*Sebastes* and *Sebastelobus*) caught. Shoreside, rockfish catch was sorted into marketable, unmarketable, and forfeited. Unmarketable catch was typically made up of small fish of no value and rockfish landings exceeding monthly cumulative trip limits were forfeited. Rockfish discard estimates in this study are assumed equal to the sum of forfeited and unmarketable, because this catch would have ordinarily been discarded at-sea under normal fishing operations. Observers also monitored fishing strategies and collected data to estimate total catch, discard and bycatch rates of incidental catch of non-rockfish species.

Results

Participating vessels landed approximately 810 mt of arrowtooth flounder that would not have been possible without the EFP fishery. The estimated bycatch rate for canary rockfish in the north coastal Washington arrowtooth fishery is significantly lower than that used to set current regulations for the arrowtooth fishery in 2002. In arrowtooth directed tows, the ratio of canary to arrowtooth was 0.07% compared to an assumed rate of 2.0% to 3.0%. Among the 7 vessels participating in the study, the highest canary discard rate for a single vessel was 1.9%. Two vessels caught no canary. This questions the ability for at least some vessels to avoid canary rockfish in directed arrowtooth tows. This also suggests that predicting bycatch may be highly prone to error.

Although the relative volume of catch was low, the percent discard within rockfish market category was much higher.

Total estimated rockfish catch and discard

Species/Market Category	Total Estimated Catch(lbs)	Discard(lbs)	Discard Rate
Canary	5,226	2,574	49.3%
Darkblotched	4,359	22	0.5%
POP	28,099	4,528	16.1%
Shortspine Thornyhead	14,893	3,838	25.8%
Shelf	21,656	12,193	56.3%
Slope	15,851	5,922	37.4%
Widow	632	-	0.0%
Yellowtail	41,975	10,014	23.9%
Sub-Total	132,691	39,091	29.5%

Data Limitation

Analysis in this study is based on data collected from seven volunteer vessels and does not represent a random sampling of the fleet. Because this study is limited in scope, results should not be widely applied to other fisheries. Furthermore, vessels participating in this study actively attempted to minimize canary bycatch and discard rates may not be representative of other vessels targeting arrowtooth.

Introduction

Arrowtooth flounder (*Atheresthes stomias*) are an extremely important species in the coastal Washington groundfish fisheries. Washington fishers and processors have succeeded in developing important overseas markets for this species. A large component of the Washington trawl fleet, and at least two major processors, are heavily dependent upon arrowtooth flounder for their livelihoods. In 2000, arrowtooth flounder comprised approximately one-third of all Washington non-whiting groundfish landings.

In recent years, the PFMC has been presented with information that suggests canary and several other rockfish stocks are severely depressed and below $B_{25\%}$. As a result, rebuilding plans have been initiated and more restrictive management measures have been adopted. In 2001, the PFMC placed restrictive limits on the flatfish fishery (which includes arrowtooth) based on an assumed canary bycatch rate of 1%. Trip limits beginning in July limited fishers to 30,000 lbs/month for all flatfish (except Dover sole). A more restrictive 10,000lbs/month trip limit for arrowtooth was enacted for directed arrowtooth fishing because the canary bycatch rate was assumed to be two to three percent. Fishers who historically targeted arrowtooth flounder stated that their current bycatch rate of canary rockfish is less than one percent and perhaps as low as 0.2%.

Using federal groundfish disaster relief funding, WDFW proposed a 2-year cooperative industry at-sea data collection program in an effort to facilitate directed Arrowtooth flounder fishing while simultaneously establishing an objective basis for estimation of canary rockfish discard in that fishery. This report provides a review of the 2001 (year 1) observer data and an estimate of discarded catch for the participating vessels. A final report will be produced in 2003 summarizing results of the entire program.

Review of Terms and Conditions of Permit

The cooperative industry at-sea data collection program was contingent upon and received approval from PFMC and NMFS. This program was prescribed through an Exempted Fishing Permit (EFP) process in which NMFS approved and provided a permit to Washington Department of Fish and Wildlife (WDFW). Under the terms of the permit, WDFW authorized qualifying processors and fishers to participate in the arrowtooth EFP fishery.

Since the observer program is voluntary, WDFW recognized the need to provide fishers with incentives to carry observers to verify the total catch and bycatch occurring in the fishery. Working through the PFMC process, WDFW provided fishers with the opportunity to land arrowtooth flounder and petrale sole in excess of the current monthly limits while collecting canary rockfish bycatch data through an observer program. Because funding was limited, WDFW developed strict qualifying criteria for EFP participation based on arrowtooth landing history. Only seven vessels (Carla R, Friendship, Larkin, Miss Leona, Pacific Oryan, Starlight and Windjammer) qualified and two Bellingham, Washington processors (Bornstein and Sea-K) processed landings. As a consequence, the observations from this program do not represent a random sampling of the LLP fleet fishing Washington's coastal waters. It does reflect catch and bycatch rates among the Bellingham based trawl fleet participating in this EFP. Participants landed 25% of the total Arrowtooth flounder catch taken off Washington, Oregon, and California in 2001.

All participating vessels carried observers throughout the study period and were required to follow trip limit regulations established for the arrowtooth EFP fishery. Trip limits affecting participating vessels included a monthly cumulative canary catch trigger of 200 pounds. If a vessel reached the trigger, no further directed arrowtooth fishing was allowed for the remainder of the month. This reduced the possibility that EFP participants would not significantly exceed the limited entry 300-pound monthly cumulative trip limit for canary. All catch counted toward the vessel's monthly cumulative trip limit for all species or species groups. Participating vessels were also required to retain all rockfish species (*Sebastes* and *Sebastelobus*) caught; much of this catch would normally be discarded at-sea. This ensured a complete census of all incidental rockfish catch.

Although not required by the EFP, vessels in the program attempted to minimize incidental rockfish bycatch in directed and non-directed tows. Several vessels used gear modifications and/or actively avoided areas known for high bycatch rates of canary.

Program Objective

The primary motive of the arrowtooth observer program was to estimate incidental catch rates for canary and other rockfish species associated with the coastal Washington arrowtooth flounder fishery. Information may also be used to augment the NMFS' Pacific Coast Groundfish Observer Program, but was not intended to replace it. A secondary objective was evaluation of the rockfish full retention provisions of the program. The scope of the study included data collection to monitor fishing strategies and estimate total catch, discard and bycatch rates of incidental catch of non-target species.

Methods

At Sea Sampling

Under terms of the permit, the arrowtooth EFP fishery began August 1, 2001, and ended September 30, 2001. During this time period, each vessel carried a single observer hired and trained by WDFW personnel. Vessel operators had to accept an assigned observer and had no influence on their placement. The observer's primary mission was to collect canary rockfish catch information for each sampled tow (the sampling unit). Secondary objectives included sampling bycatch for species composition and enumerating incidence of prohibited species (halibut and salmon) in each tow. Observers were also directed to collect biological data on various fish species. A list of observer's main duties included: 1) record whether the tow was a directed or non-direct arrowtooth flounder tow; 2) enumerate, by species, all live fish discarded; 3) provide information on average size of discard (live and dead); 4) estimate total discard weight using the skipper's estimate, visual observation, or sorted and weighed basket samples; 5) ensure that all canary rockfish from each tow were set aside, enumerated and measured; 6) record species composition data for the discarded and retained portion of the catch; and 7) record notes on anything that might have affected the performance of the above protocol.

Shoreside Sampling

WDFW port sampling and shoreside observer personnel collected species composition and biological samples from the marketable and unmarketable portion of the landed catch. The shoreside observer was solely responsible for debriefing observers and sampling the unmarketable portion of the catch. Mixed rockfish landings that could not be whole-sampled were basket-sampled so that species composition could be estimated. Additional length frequency samples were collected on retained unmarketable rockfish. Individual fish weights were collected to enable construction of a length/weight regression formula to convert at-sea length frequency observation to weight. If time did not permit individual length-weight sampling, species were separated, counted and each basket weighed to provide information on average weight.

Analytical Procedures

Logbook and observer data were reviewed to determine if a tow was successfully completed. Tows were considered unsuccessful and not included in the analysis if: 1) tows were primarily dogfish shark and dumped before being brought onboard; 2) damaged net tows with little or no catch; or 3) recorded as unsuccessful no-catch tows due to gear problems.

Market categories are used to identify any single or multi-species group, which has a size or limit (OY) restriction. Vessel operators and buyers/processors are required to

document fish caught (hailed) or landed (fish ticket) for each market category. Market categories may include marketable, unmarketable and forfeited catch.

For each vessel's trip, hailed catch is stratified by tow number, tow type (directed/non-directed) and market category. Fish ticket data are stratified by market category and vessel trip. To allow comparison of the amount of market category catch by tow and between directed and non-directed tows, hailed catch is adjusted to correspond to the total weighed catch (from fish tickets) for each market category.

For each tow in a given trip, hailed catch (recorded in logbooks) was adjusted to reflect landed catch for each market category as follows:

C_i^m = landed weight of market category i

C_{ij}^h = hailed weight of market category i in the j^{th} tow (j = 1 to n)

$\hat{C}_{ij}$ = the estimated actual weight of the catch of market category i, during tow j

$$\hat{C}_{ij} = C_i^m \left(C_{ij}^h \Big/ \sum_{j=1}^{n} C_{ij}^h \right)$$

If a species or a mixed species market category was landed but not hailed (unrecorded in the skipper's logbook), catch was evenly distributed across all tows for the vessel trip, i.e.,

$$\hat{C}_{ij} = C_i^m / n$$

Rockfish Discard Estimation

EFP requirement for full retention of rockfish ensured that incidental catch of rockfish would be known. Shoreside, rockfish catch was sorted into marketable, unmarketable, and forfeited. Unmarketable catch was typically made up of small fish of no value. Forfeitures were rockfish landings exceeding monthly cumulative trip limits and included unmarketable and marketable rockfish. The unmarketable and forfeited catch would have ordinarily been discarded at-sea under normal fishing operations. Rockfish discard estimates in this study are assumed equal to the sum of forfeited and unmarketable catch.

For a given trip, the species specific catch for each market category (marketable or unmarketable) was estimated as follows:

Cj is the total landing weight in market category j,

W_{jk} is the species composition sampled weight of species k (k=1 to m) from market category j , and

$\hat{C}_{jk}$ is the estimated total landing weight of the species k from market category j

$$\hat{C}_{jk} = C_j \left(W_{jk} \Big/ \sum_{k=1}^{m} W_{jk} \right)$$

Non-Rockfish Discard Estimation

Unmarketable non-rockfish catch was discarded at sea. Non-rockfish discard was estimated for all tows where observers recorded both discarded catch weight and species composition of the discarded catch. Catches were either sub-sampled (basket samples) or whole haul sampled for species composition. Weight of unmarketable species was either measured directly on a platform scale or estimated from the number of fish recorded in the sample. When fish were counted but not weighed, numbers of fish were converted to weight by multiplying number in the sample by their estimated mean weight. [See at-sea sampling for estimation of mean weight.]

For each vessel trip and each tow type, total estimated discard per tow was distributed to the species level based on at-sea species composition of the sampled discard catch, where

D_j is the total non-rockfish discarded catch weight in tow j,

W_{jk} is the species composition sampled weight of species k (k=1 to n) from tow j , and

$\hat{D}_{jk}$ is the estimated total discard weight of the species k from tow j

$$\hat{D}_{jk} = D_j \left(W_{jk} \Big/ \sum_{k=1}^{n} W_{jk} \right)$$

There was a record of tow type for every tow from every trip; however, despite the presence of observers, there may be no record of sampled catch for some tows. In these circumstances, discarded catch was estimated based on the average species discard within the sampled trip for sampled tows. For each vessel trip and tow type where sampling data was missing, discarded catch was assumed equal to the simple average of estimated discard for each species ($\overline{D}_k$) in sampled tows during that trip. For those trips where there is no record of sampled catch for any tow, discarded catch was estimated based on the number of unsampled tows and the average species specific discard for the vessel and tow type over all trips.

Results

Tow Data

There were 2,165,260 pounds (982 mt) hailed in logbooks by the seven participating vessels, which collectively made 41 trips and 577 tows during the arrowtooth EFP fishery (Table 1). Arrowtooth flounder catch weight exceeded 1,000 pounds in 65% of the directed tows and 12.6% of non-directed tows.. Skipper's logged catches of canary rockfish in 12.9% of directed and 26.4% of the non-directed tows (Table 2). Catch was brought onboard and retained in approximately 95% of the tows (Table 3).

Each fisher considers multiple factors before making a decision on target species. These included permit regulations, trip limit attainment, fishing expertise (in directing arrowtooth tows) and individual differences in general fishing strategy. Participating vessels displayed a broad range of proficiency in directing their arrowtooth flounder tows.

Vessel A targeted arrowtooth in 23.5% of his tows, the lowest rate among EFP participating vessels. This was due to Vessel A exceeding the canary trip limit of 200 pounds during the first trip in August. The EFP prohibited arrowtooth targeting for the remainder of the month for this vessel. Arrowtooth target rates for remaining vessels ranged from 47.2 % (vessel B) to 73.4% (vessel C) of tows. Among the seven vessels in the study, tow rate success ranged from a high of 98% for the vessel A and a low of 88% for vessel C (Table 4). Although there was no obvious trend in vessel success rate, vessel C had higher catches of slope rockfish species than other vessels indicating a deeper and possibly "rocky" target fishing location.

Tow frequency analysis of hailed canary catch indicates that canary catches exceeding 100 pounds were rare in both directed and non-directed tows. The monthly cumulative canary catch limit of 200 pounds for directed tows was exceeded only once, during the first trip for vessel A. A large majority (87%) of directed tows caught no canary and tows with canary were generally below 50 pounds (Figure 2). Approximately 74% of the non-directed tows caught no canary and catches exceeding 100 pounds were rare (Figure 3). Only two non-directed tows caught canary catch in excess of 200 pounds.

Comparisons of fish ticket adjusted catch among tows indicate to some extent the random nature of incidental rockfish catch in tows. However, distinct differences in the catch frequency and amount of rockfish catch between vessels are apparent (Figure 4 - 10). Although comparison of tow specific catch is somewhat inexact, due to an equal distribution across all tows for non-hailed landed catch, frequency of occurrence for tows exceeding 100 lbs of canary was most prevalent for Vessel A which accounted for most of the canary caught. Generally, vessels can be grouped based on frequency of occurrence of relatively "large" tows of either slope or shelf rockfish. Vessels which had greater occurrence of slope species include vessels B, C, and G and vessels with a greater occurrence of shelf species included A, D, E and F).

Catch Data

There was a total of 2,404,611 pounds reported in 41 landings from vessels participating in the arrowtooth EFP fishery. The majority of the catch was arrowtooth, which by weight was 74.3 % of the total landed catch. Flatfish (including arrowtooth), rockfish, roundfish (lingcod, Pacific cod, Pacific whiting and sablefish) and miscellaneous species accounted for 84.9%, 5.3%, 6.8% and 3.0% of the total landed catch respectively (Table 5).

Although vessels were compensated for nearly all (95%) of the landed catch, 26.8% of rockfish were either of no value or forfeited. Fish of no value (weigh-back) were generally too small to market and rockfish forfeited to the state were in excess of trip limits. Surprisingly few rockfish (2.7%) were weigh-backs and may reflect processors' ability to find new markets for small fish that typically are not landed. A much larger portion (24.1%) of rockfish was in excess of trip limits and forfeited to the state (Table 6).

Arrowtooth directed tows accounted for almost all (92.1%) of the arrowtooth landings and the majority of rockfish landings (67.3%). Differences in rockfish composition were apparent between directed and non-directed tows (Table 7). The majority of canary (68.6%), darkblotched (84%), shelf rockfish (67.3%) and yellowtail rockfish (60.2%) were caught in non-directed tows. Directed tows caught most of the Pacific ocean perch (90.2%), shortspine thornyhead (60.5%) and slope rockfish (88.2%).

Comparison of catch data between vessels indicates similar target strategies for non-directed tows (Table 8). Vessels generally targeted a DTS mix (dover sole, thornyhead rockfish and sablefish) or a flatfish mix of petrale, English sole and dover. While not directly targeted, arrowtooth was the largest portion of the catch for all vessels and petrale sole ranked second for five of the seven vessels (Table 9). Rockfish composition in non-directed tows was fairly similar among vessels, but total volume was not. Rockfish represented 2-23% of total individual vessel catch and three vessels caught 80% of all rockfish.

As anticipated, catch in directed tows was dominated (83-97%) by arrowtooth (Table 10). Although rockfish composition was somewhat similar among vessels for non-directed tows, rockfish composition in directed tows differed (Table 11). There were generally two groups of vessels based on rockfish composition of the catch in directed tows. Vessels that primarily caught slope rockfish species (slope strategy) and POP (vessels B, C, and G) and vessels that primarily caught shelf rockfish species (shelf strategy) and shortspine (vessels A, D, E and F). Slope and shelf strategy vessels catch are also reflected in catch composition unmarketable and forfeited catch. Dissimilarity in rockfish catch composition in directed tows probably points to variation in a vessel's trawl gear, preference in target area and/or fishing strategy for directed tows.

At-Sea Sampling

An estimate of total discard was collected for approximately 63% of the successful tows. Estimates of total discard with accompanying species composition data, necessary to identify which species comprised the discarded portion of the catch, was collected for 55% of the tows. Discard sampling rate varied significantly among vessels. Discard could be estimated for almost 87% of the tows for vessel F while only 17% of the tows had sufficient data to estimate discard aboard vessel E (Table 12). All tows are assumed to have been observed, but there was no observer record for 21.7% of tows.

Hailed catch information in the trawl logbook was sufficient to estimate tow specific rockfish catch to the market category level in 78% of all tows. If a rockfish species or mixed species market category was landed, but not hailed, than the catch was evenly distributed to all tows. Approximately 13 % of the tows that hailed rockfish were not sampled and 22% of tows that were sampled for rockfish did not have accompanying hail information (Table 13). Tow specific catch for individual species landed in mixed rockfish market categories was not estimated.

Mean weight was estimated from weighed basket-samples of discard where weight and numbers were collected for individual species. Weight data were not collected for several minor discard species including flathead sole, sand sole, walleye pollock and wolf-eel. A one pound average was assumed for all these species except wolf-eel where mean weight was assumed to be three pounds (Table 14). Mean weight was similarly estimated from weighed basket-samples of 18 species of retained rockfish (Table 15).

Observers were also requested to collect information on discard of species that were immediately released after the capture such as salmon, halibut, lingcod, sablefish and crab. Observer information for these species was sufficient to estimated discard in approximately 88% of tows.

Shoreside Sampling

A WDFW port sampler collected species composition and biological samples for the marketable portion of the catch. A total of 6 of the 41 EFP landings (15%) were intercepted and sampled for species composition and biological specimens.

The observer coordinator was responsible for sampling the forfeited and unmarketable portion of the catch for species composition and collecting biological samples on sex, length and weight. The coordinator intercepted and sampled 19 of 41 EFP landings (46%). Individual length-weight (Table 16) and basket-weight data for 20 species of fish were collected (Table 17). Data collected from unsorted catch and sorted unmarketable catch were pooled for each species to obtain an estimate of mean weight. Average weight was considerably lighter for unmarketable fish compared to that retained illustrating the comparatively small size of unmarketable fish (Table 18).

Discard

Total fishing mortality estimates of groundfish are essential for managing fisheries and estimating stock abundance. Optimal yields are determined by deducting estimated or presumed discard from total specified catch. Discard is the fraction of the utilized and unutilized volume of catch that can be computed as a fraction of: 1) total catch of all Groundfish; 2) total catch of target species or species group; 3) the total retained groundfish catch; or 4) total retained catch on a species-specific or mixed-species group basis. Council management recommendations are typically based on species-specific discard percentages computed from retained catch. As reported in this study, species-specific discard rates can be very high even though the absolute volume of discard is low.

Total estimated discard rate for the EFP arrowtooth fishery was 28% by weight for all species combined (Table 19). There were large disparities in discard rates between species and species groups. Discard rate for flatfish, rockfish, roundfish and miscellaneous species were 17.5%, 26.8%, 23.7%, 84.1% respectively. All catch of prohibited species such as halibut (75,191 lbs.) was discarded and for unmarketable species eelpout (583 lbs.), ratfish (53,481 lbs.), sculpin (221 lbs.), shad (4,481 lbs), snailfish (31 lbs.) and wolfeel (38 lbs.). Pacific whiting (4,660 lbs.), dogfish shark (259,512 lbs.) and skate (68,201) discard was mainly due to market restraints and small size. Discard rate for Pacific whiting, dogfish shark and skate was 87.2%, 79.4% and 92.5% respectively. Discard of dogfish shark are probably grossly underestimated because a number of large volume tows of dogfish were dumped prior to being brought onboard and discard was not estimated nor included in this study. Arrowtooth discard (184,348 lbs., 9.8% of total catch) was due to small size and/or if caught early in the trip and were discarded because they could not be preserved in marketable condition for more than several days.

Discard length and weight information suggests that discard for a number of species was largely due to catch of small unmarketable fish. Although market limits may have contributed to discard, length frequency and weight information collected on discard for petrale sole (30.8% of total catch, 46,943 lbs), dover sole (42.8% of total catch, 54,832 lbs) English sole (14.2% of total catch, 8,560 lbs), “other” flatfish (58.5% of total catch, 26,561 lbs), rex sole (83.1% of total catch, 19,921 lbs) and sand sole (73.6% of total catch, 220 lbs) were nearly all small fish. Mean weight for fish discarded at sea was generally one pound or less (Table 14) and mean size frequency was small (Table 20 and Figure 11).

Non-Directed Tows Versus Directed Tows

Although non-directed tows accounted for only one-third of the total estimated landings they contributed 50% of the total estimated discard. Total estimated discard for all species combined was 47.0 % and 19.8 % for non-directed and directed tows respectively (Table 21). Discard of dogfish shark and flatfish accounted for much of the difference. Nearly 70% of the total estimated discard of dogfish (259,512 lbs.) came from non-directed tows. However, this estimate is grossly underestimated because large catches of

dogfish are dumped before coming onboard and cannot be included in estimates. Discard rate for flatfish was also much higher in non-directed tows (34.8 %) than directed tows (13.3%) due to an increased retention of arrowtooth in directed tows. All discard of lingcod (6,116 lbs.), Pacific whiting (4,660 lbs.) and sablefish (40,187 lbs.) came from non-directed tows. Lingcod and sablefish discard was due to both catch of unmarketable fish and attainment of trip limits. Whiting was generally unmarketable.

Discard rates of rockfish were similar in non-directed (28.7 %) and directed tows (25.2 %), but there were differences in rockfish composition and discard rates among species and species groups. Canary discard in non-directed tows (1,239 lbs.) was 35.7% of the total estimated canary catch (3,471 lbs.); whereas, 73.5% (1,585 lbs) was discarded in directed tows. Nearly 72% of the shelf rockfish discard (9,983 lbs.) was from non-directed tows, while 95% of slope rockfish discard (3,404 lbs.) is attributed to directed tows.

Dissimilarity in rockfish discard between non-directed and directed tows is reflected in the ratio of discard to landed catch (Table 22). With the exception of POP and slope rockfish, the ratio of rockfish discard to landed catch for all rockfish species and species groups, was higher in non-directed tows. Canary discard ratio to total landed catch was very low: 0.24 % in directed tows and 0.06 % in arrowtooth directed tows. Shelf rockfish discard ratio to total landed catch was 1.39 % in non-directed tows and 0.15 % in arrowtooth directed tows. Discard ratio in non-directed tows for slope (0.04 %) and POP (0.10 %) was lower than the slope (0.17 %) and POP (0.21 %) discard ratio to in directed tows.

Vessel Comparison

Discard and discard rates of species and species groups between vessels in both non-directed and directed tows were somewhat dissimilar (Table 23 and 24). This was especially evident for discard and discard rate of rockfish. Vessel A was largely responsible for the total canary, shortspine thornyhead, and shelf rockfish discard. Vessel B was largely responsible for the total, POP, shortspine thornyhead, shelf, slope and yellowtail rockfish discard (Table 25). Species composition largely reflects differences in target strategy where Vessel A targeted on-shelf areas and Vessel B targeted deeper areas near the shelf break. However, the high degree of variability in bycatch rates between vessels fishing in the same general location indicates that predicting bycatch may be highly prone to error.

Nearly all rockfish discard was trip limit induced. Forfeited rockfish catch in excess of trip limits (which would have been discarded at-sea) accounted for 91% of the total rockfish discard. Shortspine thornyhead rockfish was the only rockfish species where most of the discard was unmarketable because of size (Table 26 and Table 27). All of the canary landed was marketable and all estimated discard was in excess rockfish trip limits and forfeited. Monthly and bi-monthly cumulative catch limits for rockfish species are summarized in Table 28.

Discard of sablefish and lingcod was due to catch in excess of trip limits and/or catch of unmarketable small fish. Vessel A accounted for approximately 50% of the total estimated lingcod discard and Vessel F accounted for 64% of the total estimated discard of sablefish (Table 23 and 24). Length information for lingcod was inadequate to assess the amount discard due to catches of unmarketable small fish. Review of retained and discard catch by tow indicate that there was lingcod discard due to trip limits. However, at least a portion of the discarded catch was catch that was discarded prior to exceeding the monthly trip limit of 400 lbs (Figures 12 to 18) for nearly all vessels.

Length information on discarded sablefish indicates that much, but not all sablefish were discarded due to catch of small, unmarketable fish (Table 20 and Figure 11). Retained catch data show that the bi-monthly cumulative limit on sablefish was achieved twice. Vessel B and Vessel F reached the bi-monthly trip limit (for September and October) during September. Tows with an estimated 3,750 lbs and 3,000 lbs of sablefish were observed discarded following trip limit attainment (Figures 13 and 17). This discard would represent approximately 17% of the total 40,194 lbs of estimated sablefish discard. The remainder of sablefish discard was prior to trip limit attainment and can likely be attributed to catch of small, unmarketable fish.

Discussion

The estimated bycatch rate for canary rockfish in the north coastal Washington arrowtooth fishery is significantly lower than that used to set current regulations for the arrowtooth fishery in 2002. In arrowtooth directed tows, the ratio of canary to arrowtooth was 0.07% compared to an assumed rate of 2.0% to 3.0%. Among the seven vessels participating in the study, the highest canary discard rate for a single vessel was 1.9%. Two vessels caught no canary. This questions the ability for at least some vessels to avoid canary rockfish in directed arrowtooth tows. This also suggests that predicting bycatch may be highly prone to error.

Analysis in this study is based on data collected from seven volunteer vessels and does not represent a random sampling of the fleet. Because this study is limited in scope, results should not be widely applied to other fisheries. Furthermore, vessels participating in this study actively attempted to minimize canary bycatch and discard rates may not be representative of other vessels targeting arrowtooth.

Changes within the program are needed to meet sampling challenges and redefined study objectives. Data collection during the second year of the study will be entirely focused on tow specific rockfish catch. These data will provide necessary information to estimate species-specific rockfish catch and discard for each tow. This information will provide us with a better understanding of rockfish distribution and co-occurrence of groundfish species in coastal Washington waters.

Full retention of rockfish, during this study, ensured a complete census of rockfish catch during a vessel trip. Regulations requiring full-retention across the fleet, would greatly add to our current knowledge of coincident catch rates and provide a means to fully account for fishing mortality. Catch rates observed during the NMFS' observer program could be used to verify catch rates from non-observed vessels.

Tables

Table 1. Summary of all tows recorded in logbooks during the arrowtooth EFP fishery.

Summary of arrowtooth EFP logbook data.

[1]Directed	Successful	Total Number of Tows	Number of tows with >1000 lbs ARTH	Hailed Pounds Gross	Arrowtooth	Canary
No	No	15	0	0	0	0
Yes	No	13	0	153	0	0
No	Yes	246	31	452,870	122,310	2,556
Yes	Yes	303	197	1,712,237	1,496,370	1,148
Total		577		2,165,260	1,618,680	3,704

1/ Directed arrowtooth tows.

Table 2. Summary of total, arrowtooth and canary catch for non-directed and directed tows.

Summary of arrowtooth EFP logbook data for successful tows.

[1]Directed	Percent of tows with >0 lbs Canary	Percent of tows with >1000 lbs ARTH	ercent of tow with Canary	Hailed Canary/Gross Catch
No	26.4%	12.6%	26.4%	0.56%
Yes	12.9%	65.0%	12.9%	0.07%

1/ Directed arrowtooth tows.

Table 3. Summary of unsuccessful tow data

Summary of arrowtooth EFP logbook data for non-successful tows.

[1]Directed	Percent of tows that failed	Reason for tow failure Damaged Net	Mostly Dogfish	Other
No	5.7%	4	4	7
Yes	4.1%	8	2	3

1/ Directed arrowtooth tows.

Table 4. Vessel comparison of unsuccessful and successful tows.

Summary of arrowtooth EFP logbook data.					
		Number of tows		% of Tows	
Vessel	Directed	Non-Directed	Total	Directed	Non-Directed
		Unsuccessful Tows			
A	0	2	2	0.0%	100.0%
B	2	2	4	50.0%	50.0%
C	9	2	11	81.8%	18.2%
D	1	2	3	33.3%	66.7%
E	0	4	4	0.0%	100.0%
F	0	2	2	0.0%	100.0%
G	1	1	2	50.0%	50.0%
Total	13	15	28		
		Successful Tows			
A	22	72	94	23.4%	76.6%
B	25	28	53	47.2%	52.8%
C	69	25	94	73.4%	26.6%
D	61	24	85	71.8%	28.2%
E	50	46	96	52.1%	47.9%
F	34	33	67	50.7%	49.3%
G	42	18	60	70.0%	30.0%
Total	303	246	549		

Table 5. Total retained catch for all vessels participating in the study.

Fish Ticket Landing Data		
Species	Total (lbs)	% of Total
	Flatfish	
ARTH	1,786,925	74.3%
DOVR	73,839	3.1%
EGLS	51,894	2.2%
OFLT	17,493	0.7%
PTRL	105,440	4.4%
REX	4,037	0.2%
RSOL	1,332	0.1%
SSOL	79	
Sub-Total	2,041,039	84.9%
	Rockfish	
CNRY	5,056	0.2%
DBRK	4,359	0.2%
POP	28,099	1.2%
SSPN	14,893	0.6%
USLF	19,446	0.8%
USLP	13,333	0.6%
WDOW	632	0.0%
YTRK	41,975	1.7%
Sub-Total	127,793	5.3%
	Roundfish	
LCOD	3,460	0.1%
PCOD	77,350	3.2%
PWHT	693	0.0%
SABL	82,958	3.4%
Sub-Total	164,461	6.8%
	Miscellaneous	
DSRK	68,152	2.8%
OCTP	164	0.0%
SKAT	2,838	0.1%
SSRK	47	0.0%
MISC	117	0.0%
Sub-Total	71,318	3.0%
Grand Total	**2,404,611**	**100%**

Table 6. Comparison of total catch and percent of catch which was sold, forfeited or unmarketable.

Fish Ticket Adjusted Logbook Data

Species	Total (lbs)	% of Total	Non-Dir. (lbs)	Directed (lbs)	Non-Dir. (%)	Directed (%)
			Flatfish			
ARTH	1,786,925	74.3%	141,003	1,645,922	7.9%	92.1%
DOVR	73,839	3.1%	43,384	30,455	58.8%	41.2%
EGLS	51,894	2.2%	45,395	6,499	87.5%	12.5%
OFLT	17,493	0.7%	7,930	9,563	45.3%	54.7%
PTRL	105,440	4.4%	75,912	29,528	72.0%	28.0%
REX	4,037	0.2%	1,326	2,711	32.8%	67.2%
RSOL	1,332	0.1%	1,311	21	98.4%	1.6%
SSOL	79		-	79	0.0%	100.0%
Sub-Total	2,041,039	84.9%	316,260	1,724,779	15.5%	84.5%
			Rockfish			
CNRY	5,056	0.2%	3,471	1,585	68.6%	31.4%
DBRK	4,359	0.2%	3,661	698	84.0%	16.0%
POP	28,099	1.2%	2,759	25,340	9.8%	90.2%
SSPN	14,893	0.6%	5,875	9,018	39.5%	60.5%
USLF	19,446	0.8%	13,094	6,352	67.3%	32.7%
USLP	13,333	0.6%	1,571	11,762	11.8%	88.2%
WDOW	632	0.0%	632	-	100.0%	0.0%
YTRK	41,975	1.7%	25,266	16,709	60.2%	39.8%
Sub-Total	127,793	5.3%	41,767	86,026	32.7%	67.3%
			Roundfish			
LCOD	3,460	0.1%	2,222	1,238	64.2%	35.8%
PCOD	77,350	3.2%	50,189	27,161	64.9%	35.1%
PWHT	693	0.0%	628	65	90.6%	9.4%
SABL	82,958	3.4%	33,705	49,253	40.6%	59.4%
Sub-Total	164,461	6.8%	86,552	77,909	52.6%	47.4%
			Miscellaneous			
DSRK	68,152	2.8%	68,152	-	100.0%	0.0%
OCTP	164	0.0%	164	-	100.0%	0.0%
SKAT	2,838	0.1%	2,731	107	96.2%	3.8%
SSRK	47	0.0%	47	-	100.0%	0.0%
MISC	117	0.0%	-	-	0.0%	0.0%
Sub-Total	71,318	3.0%	71,094	107	99.7%	0.2%
Grand Total	**2,404,611**	**100%**	**515,673**	**1,888,821**	**21.4%**	**78.5%**

Table 7. Comparison of catch data between non-directed and directed tows.

Fish Ticket Adjusted Logbook Data

Species	Total (lbs)	% of Total	Non-Directed (lbs)	Directed (lbs)	Non-Directed (%)	Directed (%)
			Flatfish			
ARTH	1,786,925	74.3%	141,003	1,645,922	7.9%	92.1%
DOVR	73,839	3.1%	43,384	30,455	58.8%	41.2%
EGLS	51,894	2.2%	45,395	6,499	87.5%	12.5%
OFLT	17,493	0.7%	7,930	9,563	45.3%	54.7%
PTRL	105,440	4.4%	75,912	29,528	72.0%	28.0%
REX	4,037	0.2%	1,326	2,711	32.8%	67.2%
RSOL	1,332	0.1%	1,311	21	98.4%	1.6%
SSOL	79		-	79	0.0%	100.0%
Sub-Total	2,041,039	84.9%	316,260	1,724,779	15.5%	84.5%
			Rockfish			
CNRY	5,056	0.2%	3,471	1,585	68.6%	31.4%
DBRK	4,359	0.2%	3,661	698	84.0%	16.0%
POP	28,099	1.2%	2,759	25,340	9.8%	90.2%
SSPN	14,893	0.6%	5,875	9,018	39.5%	60.5%
USLF	19,446	0.8%	13,094	6,352	67.3%	32.7%
USLP	13,333	0.6%	1,571	11,762	11.8%	88.2%
WDOW	632	0.0%	632	-	100.0%	0.0%
YTRK	41,975	1.7%	25,266	16,709	60.2%	39.8%
Sub-Total	127,793	5.3%	41,767	86,026	32.7%	67.3%
			Roundfish			
LCOD	3,460	0.1%	2,222	1,238	64.2%	35.8%
PCOD	77,350	3.2%	50,189	27,161	64.9%	35.1%
PWHT	693	0.0%	628	65	90.6%	9.4%
SABL	82,958	3.4%	33,705	49,253	40.6%	59.4%
Sub-Total	164,461	6.8%	86,552	77,909	52.6%	47.4%
			Miscellaneous			
DSRK	68,152	2.8%	68,152	-	100.0%	0.0%
OCTP	164	0.0%	164	-	100.0%	0.0%
SKAT	2,838	0.1%	2,731	107	96.2%	3.8%
SSRK	47	0.0%	47	-	100.0%	0.0%
MISC	117	0.0%	-	-	0.0%	0.0%
Sub-Total	71,318	3.0%	71,094	107	99.7%	0.2%
Grand Total	**2,404,611**	**100%**	**515,673**	**1,888,821**	**21.4%**	**78.5%**

Table 8. Vessel comparison of total catch in non-directed tows.

Fish Ticket Adjusted Logbook Data for Non-Directed Tows

Species	A	B	C	D	E	F	G
				Flatfish			
ARTH	21,276	15,243	25,837	15,705	29,299	24,970	8,673
DOVR	14,061	9,342	1,882	3,517	4,270	6,359	2,594
EGLS	19,692	6,894	1,557	6,184	1,714	2,162	7,080
OFLT	3,217	2,390	1,855	-	-	294	-
PTRL	18,095	3,855	2,102	9,837	20,914	14,190	6,850
REX	894	-	-	-	96	-	206
RSOL	99	-	-	106	265	454	-
SSOL	-	-	-	-	-	-	-
Sub-Total	77,334	37,725	33,233	35,348	56,557	48,429	25,403
				Rockfish			
CNRY	460	-	489	356	891	175	149
DBRK	-	356	-	-	507	-	-
POP	996	-	1,095	167	134	-	119
SSPN	1,774	1,224	973	-	619	506	114
USLF	3,970	108	1,793	1,981	813	214	1,141
USLP	478	257	-	117	-	114	252
WDOW	-	-	-	139	25	-	-
YTRK	7,356	294	7,126	1,266	8,147	478	319
Sub-Total	15,035	2,240	11,476	4,027	11,135	1,487	2,095
				Roundfish			
LCOD	700	-	178	389	-	241	292
PCOD	7,232	616	1,473	2,484	26,411	6,364	4,988
PWHT	-	-	-	-	558	-	-
SABL	8,998	7,003	4,339	1,971	4,939	5,116	1,234
Sub-Total	16,930	7,619	5,990	4,845	31,908	11,721	6,514
				Miscellaneous			
DSRK	18,346	-	-	195	13,571	-	-
OCTP	-	-	-	-	-	164	-
SKAT	1,037	943	-	-	315	-	-
SSRK	-	-	-	-	-	-	-
MISC							
	19,383	943	-	195	13,886	164	-
Grand Total	**128,681**	**48,527**	**50,698**	**44,415**	**113,487**	**61,800**	**34,012**

Table 9. Vessel comparison of percent composition of total catch in non-directed tows.

Percent Composition of total catch in Non-Directed Tows

Species	A	B	C	D	E	F	G
			Flatfish				
ARTH	16.5%	31.4%	51.0%	35.4%	25.8%	40.4%	25.5%
DOVR	10.9%	19.3%	3.7%	7.9%	3.8%	10.3%	7.6%
EGLS	15.3%	14.2%	3.1%	13.9%	1.5%	3.5%	20.8%
OFLT	2.5%	4.9%	3.7%	0.0%	0.0%	0.5%	0.0%
PTRL	14.1%	7.9%	4.1%	22.1%	18.4%	23.0%	20.1%
REX	0.7%	0.0%	0.0%	0.0%	0.1%	0.0%	0.6%
RSOL	0.1%	0.0%	0.0%	0.2%	0.2%	0.7%	0.0%
SSOL	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sub-Total	60%	78%	66%	80%	50%	78%	75%
			Rockfish				
CNRY	0.4%	0.0%	1.0%	0.8%	0.8%	0.3%	0.4%
DBRK	0.0%	0.7%	0.0%	0.0%	0.4%	0.0%	0.0%
POP	0.8%	0.0%	2.2%	0.4%	0.1%	0.0%	0.4%
SSPN	1.4%	2.5%	1.9%	0.0%	0.5%	0.8%	0.3%
USLF	3.1%	0.2%	3.5%	4.5%	0.7%	0.3%	3.4%
USLP	0.4%	0.5%	0.0%	0.3%	0.0%	0.2%	0.7%
WDOW	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%
YTRK	5.7%	0.6%	14.1%	2.9%	7.2%	0.8%	0.9%
Sub-Total	12%	5%	23%	9%	10%	2%	6%
			Roundfish				
LCOD	0.5%	0.0%	0.4%	0.9%	0.0%	0.4%	0.9%
PCOD	5.6%	1.3%	2.9%	5.6%	23.3%	10.3%	14.7%
PWHT	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%
SABL	7.0%	14.4%	8.6%	4.4%	4.4%	8.3%	3.6%
Sub-Total	13%	16%	12%	11%	28%	19%	19%
			Miscellaneous				
DSRK	14.3%	0.0%	0.0%	0.4%	12.0%	0.0%	0.0%
OCTP	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%
SKAT	0.8%	1.9%	0.0%	0.0%	0.3%	0.0%	0.0%
SSRK	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
MISC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sub-Total	15%	2%	0%	0%	12%	0%	0%

Table 10. Vessel comparison of total catch in directed tows.

Fish Ticket Adjusted Logbook Data for Directed Tows

Species	A	B	C	D	E	F	G
			Flatfish				
ARTH	41,336	76,518	264,168	655,107	178,587	113,783	316,423
DOVR	2,167	8,446	5,718	718	7,897	4,143	413
EGLS	792	5	1,434	293	1,413	2	2,543
OFLT	3,806	4,044	-	3	-	1,500	-
PTRL	3,087	133	1,216	1,114	12,099	8,973	2,879
REX	1,703	-	-	25	419	-	299
RSOL	-	-	-	-	15	-	-
SSOL	-	-	-	-	-	-	-
Sub-Total	52,891	89,145	272,536	657,261	200,431	128,401	322,557
			Rockfish				
CNRY	650	-	145	-	100	124	132
DBRK	-	165	-	-	-	-	-
POP	-	958	8,561	8,131	122	-	5,293
SSPN	2,872	1,314	755	52	867	1,669	469
USLF	429	164	1,460	102	844	945	917
USLP	494	1,582	2,795	1,776	21	300	2,154
WDOW	-	-	-	-	-	-	-
YTRK	363	-	6,160	-	6,769	176	3,056
Sub-Total	4,807	4,182	19,876	10,060	8,724	3,214	12,020
			Roundfish				
LCOD	47	-	281	-	292	234	149
PCOD	832	-	2,134	301	13,817	8,956	783
PWHT	-	-	-	58	-	-	-
SABL	4,471	5,023	9,570	9,628	2,053	13,638	4,719
Sub-Total	5,350	5,023	11,985	9,986	16,162	22,828	5,650
			Miscellaneous				
DSRK	1,052	-	-	383	5,650	-	-
OCTP	-	-	-	-	-	-	-
SKAT	-	-	-	90	-	-	-
SSRK	-	-	-	-	-	-	-
MISC							
Sub-Total	1,052	-	-	473	5,650	-	-
Grand Total	**64,101**	**98,350**	**304,398**	**677,780**	**230,966**	**154,444**	**340,227**

Table 11. Vessel comparison of percent composition of total catch in non-directed tows.

Percent Composition of total catch in Non-Directed Tows

Species	A	B	C	D	E	F	G
			Flatfish				
ARTH	64.5%	77.8%	86.8%	96.7%	77.3%	73.7%	93.0%
DOVR	3.4%	8.6%	1.9%	0.1%	3.4%	2.7%	0.1%
EGLS	1.2%	0.0%	0.5%	0.0%	0.6%	0.0%	0.7%
OFLT	5.9%	4.1%	0.0%	0.0%	0.0%	1.0%	0.0%
PTRL	4.8%	0.1%	0.4%	0.2%	5.2%	5.8%	0.8%
REX	2.7%	0.0%	0.0%	0.0%	0.2%	0.0%	0.1%
RSOL	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SSOL	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sub-Total	83%	91%	90%	97%	87%	83%	95%
			Rockfish				
CNRY	1.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
DBRK	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
POP	0.0%	1.0%	2.8%	1.2%	0.1%	0.0%	1.6%
SSPN	4.5%	1.3%	0.2%	0.0%	0.4%	1.1%	0.1%
USLF	0.7%	0.2%	0.5%	0.0%	0.4%	0.6%	0.3%
USLP	0.8%	1.6%	0.9%	0.3%	0.0%	0.2%	0.6%
WDOW	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YTRK	0.6%	0.0%	2.0%	0.0%	2.9%	0.1%	0.9%
Sub-Total	7%	4%	7%	1%	4%	2%	4%
			Roundfish				
LCOD	0.1%	0.0%	0.1%	0.0%	0.1%	0.2%	0.0%
PCOD	1.3%	0.0%	0.7%	0.0%	6.0%	5.8%	0.2%
PWHT	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SABL	7.0%	5.1%	3.1%	1.4%	0.9%	8.8%	1.4%
Sub-Total	8%	5%	4%	1%	7%	15%	2%
			Miscellaneous				
DSRK	1.6%	0.0%	0.0%	0.1%	2.4%	0.0%	0.0%
OCTP	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SKAT	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SSRK	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
MISC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sub-Total	2%	0%	0%	0%	2%	0%	0%

Table 12. Vessel summary of non-rockfish discard information collected at-sea.

Non-Rockfish Discard data collected for successful tows

All Vessels

Total Discard Estimate Collected?	Sub-Sample Data Type	Number of Tows Directed	Number of Tows Non-Directed
Yes	Species Comp. (Lbs)	93	55
Yes	Species Comp. (#'s)	48	40
Yes	Species Lengths	29	37
Yes	None	17	26
No	None	76	43
No	Species Comp. (Lbs)	27	32
No	Species Comp. (#'s)	10	13
No	Species Lengths	3	0
Total		303	246
Percent of tows with sufficient data to estimate discard.		56.1%	53.7%
Percent of all tows with sufficient data to estimate discard.		55.0%	
Percent of tows without data:		21.7%	

Vessel A

Total Discard Estimate Collected?	Sub-Sample Data Type	Number of Tows Directed	Number of Tows Non-Directed
Yes	Species Comp. (Lbs)	14	24
Yes	Species Comp. (#'s)	3	9
Yes	Species Lengths	0	0
Yes	None	2	11
No	None	0	7
No	Species Comp. (Lbs)	3	20
No	Species Comp. (#'s)	0	1
No	Species Lengths	0	0
Total		22	72
Percent of tows with sufficient data to estimate discard.		77.3%	45.8%
Percent of all tows with sufficient data to estimate discard.		53.2%	
Percent of tows without data:		7.4%	

Vessel B

Total Discard Estimate Collected?	Sub-Sample Data Type	Number of Tows Directed	Number of Tows Non-Directed
Yes	Species Comp. (Lbs)	15	9
Yes	Species Comp. (#'s)	3	12
Yes	Species Lengths	0	0
Yes	None	3	5
No	None	2	0
No	Species Comp. (Lbs)	2	0
No	Species Comp. (#'s)	0	2
No	Species Lengths	0	0
Total		25	28
Percent of tows with sufficient data to estimate discard.		72.0%	75.0%
Percent of all tows with sufficient data to estimate discard.		73.6%	
Percent of tows without data:		3.8%	

Vessel C

Total Discard Estimate Collected?	Sub-Sample Data Type	Number of Tows Directed	Number of Tows Non-Directed
Yes	Species Comp. (Lbs)	15	7
Yes	Species Comp. (#'s)	24	14
Yes	Species Lengths	0	0
Yes	None	4	0
No	None	9	1
No	Species Comp. (Lbs)	13	3
No	Species Comp. (#'s)	4	0
No	Species Lengths	0	0
Total		69	25
Percent of tows with sufficient data to estimate discard.		56.5%	84.0%
Percent of all tows with sufficient data to estimate discard.		63.8%	
Percent of tows without data:		10.6%	

Table 12 (continued). Vessel summary of non-rockfish discard information collected at-sea.

Non-Rockfish Discard data collected for successful tows

Vessel D

Total Discard Estimate Collected?	Sub-Sample Data Type	Number of Tows Directed	Number of Tows Non-Directed
Yes	Species Comp. (Lbs)	25	1
Yes	Species Comp. (#'s)	14	4
Yes	Species Lengths	0	0
Yes	None	0	0
No	None	14	3
No	Species Comp. (Lbs)	7	8
No	Species Comp. (#'s)	1	8
No	Species Lengths	0	0
Total		61	24
Percent of tows with sufficient data to estimate discard.		63.9%	20.8%
Percent of all tows with sufficient data to estimate discard.		51.8%	
Percent of tows without data:		20.0%	

Vessel E

Total Discard Estimate Collected?	Sub-Sample Data Type	Number of Tows Directed	Number of Tows Non-Directed
Yes	Species Comp. (Lbs)	0	1
Yes	Species Comp. (#'s)	4	1
Yes	Species Lengths	2	8
Yes	None	1	5
No	None	38	29
No	Species Comp. (Lbs)	0	0
No	Species Comp. (#'s)	4	2
No	Species Lengths	1	0
Total		50	46
Percent of tows with sufficient data to estimate discard.		12.0%	21.7%
Percent of all tows with sufficient data to estimate discard.		16.7%	
Percent of tows without data:		69.8%	

Vessel F

Total Discard Estimate Collected?	Sub-Sample Data Type	Number of Tows Directed	Number of Tows Non-Directed
Yes	Species Comp. (Lbs)	2	1
Yes	Species Comp. (#'s)	0	0
Yes	Species Lengths	26	29
Yes	None	4	2
No	None	2	1
No	Species Comp. (Lbs)	0	0
No	Species Comp. (#'s)	0	0
No	Species Lengths	0	0
Total		34	33
Percent of tows with sufficient data to estimate discard.		82.4%	90.9%
Percent of all tows with sufficient data to estimate discard.		86.6%	
Percent of tows without data:		4.5%	

Vessel G

Total Discard Estimate Collected?	Sub-Sample Data Type	Number of Tows Directed	Number of Tows Non-Directed
Yes	Species Comp. (Lbs)	22	12
Yes	Species Comp. (#'s)	0	0
Yes	Species Lengths	1	0
Yes	None	3	3
No	None	11	2
No	Species Comp. (Lbs)	2	1
No	Species Comp. (#'s)	1	0
No	Species Lengths	2	
Total		42	18
Percent of tows with sufficient data to estimate discard.		54.8%	66.7%
Percent of all tows with sufficient data to estimate discard.		58.3%	
Percent of tows without data:		21.7%	

Table 13. Summary of rockfish discard information collected at-sea by vessel

Rockfish Data Collected in Successful Tows

Rockfish Hailed?	Sub-Sample Data Type	Vessel A	B	C	D	E	F	G	Total	Percent
Yes	Rockfish Comp. (Lbs)	28	9	43	54	15	7	33	189	34.4%
Yes	Rockfish Comp. (#'s)	9	1	3	1	1	5	0	20	3.6%
Yes	Rockfish Lengths	18	7	14	9	23	6	3	80	14.6%
Yes	None	0	8	6	12	15	22	7	70	12.8%
No	None	3	3	9	3	31	15	5	69	12.6%
No	Rockfish Comp. (Lbs)	18	4	12	5	5	1	12	57	10.4%
No	Rockfish Comp. (#'s)	10	2	3	1	0	3	0	19	3.5%
No	Rockfish Lengths	8	19	4	0	6	8	0	45	8.2%
Total	Total Tows	94	53	94	85	96	67	60	549	100.0%

Table 14. Summary of weight-length data and estimated mean size of discarded fish.

Basket weight data collected at-sea from discarded catch.

Species	# of Baskets	# of Fish	Total Weight	Mean Weight
	Flatfish			
Arrowtooth	25	421	437	1.0
Dover	29	534	474	0.9
English	10	54	61	1.1
[1]Flathead Sole				1.0
Halibut	9	27	710	26.3
Petrale	1	13	30	2.3
Rex	24	333	154	0.5
Sandab	10	84	19	0.2
[1]Sand Sole				1.0
Slender Sole	2	8	2	0.2
	Roundfish			
Hake	44	540	1109	2.1
Lingcod	4	25	81	3.3
[1]Pollock				1.0
Sablefish	7	44	72	1.6
	Miscellaneous			
Dogfish	56	1310	2995	2.3
Ellpout	3	9	8	0.9
Ratfish	23	238	249	1.0
Sculpin	2	2	1	0.6
Shad	9	22	37	1.7
Skate	48	303	1348	4.4
Slender Sole	2	8	2	0.2
Wolf-eel				3.0
	Crab			
[1]Dungeness				1.5

[1] Average weight is assumed for these species.

Table 15. Summary of weight-length data and estimated mean size for retained rockfish (collected at-sea).

Basket weight data collected at-sea from retained rockfish catch.

Species	# of Baskets	# of Fish	Total Weight	Mean Weight
Blackgill	2	2	8	4.1
Bocaccio	7	17	138	8.1
Canary	4	6	21	3.5
Darkblotched	30	210	275	1.3
Greenstriped	51	2635	2868	1.1
POP	57	1234	2815	2.3
Redbanded	44	182	437	2.4
Redstriped	18	697	778	1.1
Rosethorn	28	171	82	0.5
Rougheye	32	215	582	2.7
Sharpchin	20	212	160	0.8
Shortraker	7	106	199	1.9
Shortspine Thornyhead	12	59	132	2.2
Silvergrey	5	8	42	5.2
Splitnose	39	1252	666	0.5
Widow	4	7	26	3.8
Yelloweye	1	3	43	14.3
Yellowtail	22	335	1188	3.5

Table 16. Individual weight-length and numbers of fish collected in port from unmarketable and forfeited catch.

Individual weight-length data collected shoreside from unmarketable catch.

Species	Total Weight	Number of Lengths	Mean Weight
	Flatfish		
Arrotooth	0.94	1	0.9
Dover	0.57	1	0.6
Rex	7.93	15	0.5
	Rockfish		
Greenstripe	6.52	11	0.6
POP	2.41	2	1.2
Rosethorn	1.06	2	0.5
Rougheye	1.54	2	0.8
Sharpchin	1.37	2	0.7
Shortspine	6.1	19	0.3
Splitnose	16.26	24	0.7
Widow	7.97	2	4.0
	Roundfish		
Sable	14.07	2	7.0
	Miscellaneous		
Dogfish	37.74	18	2.1
Skate	11.05	7	1.6

Individual weight-length data collected shoreside from forfieted catch.

Species	Total Weight	Number of Lengths	Mean Weight
Canary	651.77	151	4.3

Table 17. Summary of weight-length data and estimated mean size from unmarketable rockfish.

Basket weight data collected from unmarketable rockfish.			
Species	Weight of all Baskets	Total number of Fish Weighed	Mean Weight
Darkblotched	36.23	130	0.28
Greenspotted	1.06	2	0.53
Greenstripe	71.41	132	0.54
POP	73.03	223	0.33
Redbanded	24.62	53	0.46
Redstripe	1.36	2	0.68
Rosethorn	83.92	180	0.47
Rougheye	5.65	10	0.57
Sharpchin	50.65	104	0.49
Shortspine	29.75	117	0.25
Splitnose	664.49	1671	0.40
Yelloweye	0.51	1	0.51
Total	1042.68	2625	

Table 18. Comparisons of rockfish mean weight for unmarketable and retained rockfish.

Mean weight of unmarketable and retained rockfish catch.		
Species	Mean Weight of Unmarketable	Mean Weight of Catch
Darkblotched	0.28	1.31
Greenspotted	0.53	
Greenstripe	0.54	1.09
POP	0.34	2.28
Redbanded	0.46	2.40
Redstripe	0.68	1.12
Rosethorn	0.47	0.48
Rougheye	0.60	2.71
Sharpchin	0.49	0.75
Shortspine	0.26	2.24
Splitnose	0.40	0.53
Widow	4.0	3.8
Yelloweye	0.51	14.33

Table 19. Total estimated catch and discard for the arrowtooth EFP fishery.

Total estimated catch and discard

Species	Total Estimated Catch(lbs)	Discard(lbs)	Discard Rate
	Flatfish		
Arrowtooth Flounder	1,888,692	184,348	9.8%
Dover Sole	128,158	54,832	42.8%
English Sole	60,444	8,560	14.2%
Halibut	92,998	92,998	100.0%
Other Flatfish	45,376	26,561	58.5%
Petrale	152,366	46,953	30.8%
Rex Sole	23,958	19,921	83.1%
Sand Sole	299	220	73.6%
Sub-Total	2,392,291	434,393	18.2%
	Rockfish		
Canary	5,226	2,574	49.3%
Darkblotched	4,359	22	0.5%
POP	28,099	4,528	16.1%
Shortspine Thornyhead	14,893	3,838	25.8%
Shelf	21,656	12,193	56.3%
Slope	15,851	5,922	37.4%
Widow	632	-	0.0%
Yellowtail	41,975	10,014	23.9%
Sub-Total	132,691	39,091	29.5%
	Roundfish		
Lingcod	10,627	7,174	67.5%
Pacific Whiting	5,347	4,660	87.2%
Pacific Cod	77,350	-	0.0%
Sablefish	123,178	40,285	32.7%
Sub-Total	216,503	52,120	24.1%
	Miscellaneous		
Dogfish	326,909	259,512	79.4%
Eelpout	583	583	100.0%
Ratfish	53,481	53,481	100.0%
Sculpin	220	220	100.0%
Shad	4,841	4,841	100.0%
Skate	73,978	68,409	92.5%
Snailfish	31	31	100.0%
Wolf-eel	38	38	100.0%
Sub-Total	460,081	387,115	84.1%
	Crab		
Dungeness	96	96	100.0%
Grand Total	3,201,661	912,719	28.5%

Table 20. Length frequency distribution of discarded catch..

Length		Arrowtooth Flounder	Dogfish Shark	Dover Sole	Eelpout	English Sole	Flathead Sole	Lingcod	Pacific Whiting	Petrale Sole	Pollock	Ratfish	Rex Sole	Sablefish	Sand Sole	Sanddab	Sculpin	Shad	Skate	Slender Sole
	16	1																1		
	17	5				1						1								
	18	6			2											1				1
	19	17				1			1							1				2
	20	29			5	5			3			1							1	1
	21	20		1	4	4			1					1		1			2	1
	22	15		2		11			4					2					3	2
	23	14		3		23			11	1		2		4					4	2
	24	23		7	4	17			15			1		8		1	1		5	2
	25	19		2	9	12			33	1		7		11		1			9	
	26	47		12	3	10			40	2		8		17		2	2		7	
	27	89		12	16	12			73	1		12		24		4	2		24	
	28	115		17	24	13		1	118	3		12		32	1	1	1		16	
	29	146		27	35	9			164	3		35	1	32			3		5	
	30	154		29	38	11			173	15	1	50		31	1		3		2	
	31	150		38	32	23			169	18	1	27	1	11			1		1	1
	32	130		41	37	47			166	35	2	45	1		1			2	1	
	33	78	1	60	31	57			89	29	1	46		1			1	2		
	34	54		48	28	47		1	32	35	8	39	1				5	1		
	35	41		41	17	33			20	24	8	34	1				4	2		
	36	40	1	35	19	29	1		7	21	10	30	11				2	3		
	37	36		30	10	13			4	13	7	29	30				8			
	38	46	1	15	3	12	1			6	3	14	50				11	5		
	39	49	5	7	7	5				4	7	11	73				4			
	40	58	5	6	5	8	3			3	11	7	109				6	1		
	41	65	10	6	3	3					15	1	94				4	1		
	42	64	11	3			2			2	12		82				1	2		
	43	50	16	4	2		1	1		2	12	1	46				2	2		
	44	42	34			4	10			1	20	1	35				3	2		
	45	34	34	1			9	1		2	23	1	12				4	3		
	46	17	42				4	1		2	26		12				2	1		
	47	16	37	2			8				30	1	10					3		1
	48	5	37				7				23	1	13					3		
	49	14	38	2			19			1	17		4					2		1
	50	7	33				22	2		1	18		8					1		
	51	1	50				12	1			15	1	3					4		
	52	5	48				14			1	16		2					7		
	53	5	37				9				11		3					10		
	54	7	44				15				14		1					6		
	55	3	33	1			9				11		5					11		
	56	6	34				6				17		1					5		
	57	9	28				6	1			14		1					5		
	58	11	24				5				13		3					7		
	59	10	18				1	1			3							5		
	60	8	18				2				5							5		
	61	9	11				1				3		1					5		
	62	4	8				4											9		
	63	3	10				1				1		1					3		
	64	7	15				1				1							1		
	65	2	9				1													
	66	3	4								2									
	67	3	4				2				3							4		
	68	4	6								1							1		
	69	2	8															1		
	70		1															1		
	71		6				2											1		
	72		6																	
	73		7																	
	74																			
	75		3															1		
	76		1															1		
	77		2															1		
	78		3																	
	79		1															1		
	80+		2															7		
Total		1798	746	452	334	410	178	10	1123	226	385	418	615	174	3	12	70	139	80	14
Average		34.5	52.9	33.1	31.4	31.4	51.3	46.4	29.9	34.1	47.7	32.7	41.5	27.8	30.0	24.6	37.0	55.0	26.4	25.9

Table 21. Total estimated catch and discard for non-directed and directed tows in the arrowtooth EFP fishery.

Total estimated catch and discard

	Non-Directed Tows			*Directed Tows*		
	Total Estimated		Discard	Total Estimated		Discard
Species	Catch(lbs)	Discard(lbs)	Rate	Catch(lbs)	Discard(lbs)	Rate
			Flatfish			
Arrowtooth Flounder	204,991	71,118	34.7%	1,683,701	113,230	6.7%
Dover Sole	53,927	10,830	20.1%	74,230	44,002	59.3%
English Sole	50,154	4,765	9.5%	10,290	3,795	36.9%
Halibut	45,891	45,891	100.0%	47,107	47,107	100.0%
Other Flatfish	18,415	9,176	49.8%	26,961	17,384	64.5%
Petrale	105,080	29,186	27.8%	47,285	17,767	37.6%
Rex Sole	4,742	3,417	72.0%	19,216	16,505	85.9%
Sand Sole	280	201	71.8%	19	19	100.0%
Sub-Total	483,482	174,584	36.1%	1,908,808	259,808	13.6%
			Rockfish			
Canary	3,641	1,409	38.7%	1,585	1,165	73.5%
Darkblotched	3,661	15	0.4%	698	7	1.0%
POP	2,759	495	17.9%	25,340	4,033	15.9%
Shortspine Thornyhead	5,875	1,664	28.3%	9,018	2,174	24.1%
Shelf	15,304	9,372	61.2%	6,352	2,820	44.4%
Slope	1,571	189	12.1%	14,280	5,733	40.1%
Widow	632	-	0.0%	-	-	0.0%
Yellowtail	25,266	5,409	21.4%	16,709	4,605	27.6%
Sub-Total	58,710	18,554	31.6%	73,981	20,537	27.8%
			Roundfish			
Lingcod	9,382	7,167	76.4%	1,245	7	0.6%
Pacific Whiting	5,282	4,660	88.2%	65	-	0.0%
Pacific Cod	50,189	-	0.0%	27,161	-	0.0%
Sablefish	73,920	40,280	54.5%	49,259	6	0.0%
Sub-Total	138,773	52,107	37.5%	77,729	13	0.0%
			Miscellaneous			
Dogfish	241,185	173,789	72.1%	85,724	85,724	100.0%
Eelpout	209	209	100.0%	374	374	100.0%
Ratfish	28,329	28,329	100.0%	25,152	25,152	100.0%
Sculpin	156	156	100.0%	64	64	100.0%
Shad	2,475	2,475	100.0%	2,367	2,367	100.0%
Skate	14,509	11,671	80.4%	59,469	56,738	95.4%
Snailfish	-	-	0.0%	31	31	100.0%
Wolf-eel	-	-	0.0%	38	38	100.0%
Sub-Total	286,863	216,629	75.5%	173,217	170,486	98.4%
			Crab			
Dungeness	96	96	100.0%	0	0	100.0%
Grand Total	967,925	461,970	47.7%	2,233,736	450,845	20.2%

Table 22. Ratio of rockfish species or species group catch to landed catch in non-directed and directed tows.

Ratio of Discard to Landed Catch

	Non-Directed tows			*Directed tows*		
Species	Total	Petrale	All Flatfish	Total	Arrowtooth	All Flatfish
Canary	0.24%	1.63%	0.39%	0.06%	0.07%	0.07%
Darkblotched	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%
POP	0.10%	0.65%	0.16%	0.21%	0.25%	0.23%
Shortspine Thornyhead	0.32%	2.19%	0.53%	0.12%	0.13%	0.13%
Shelf	1.39%	9.44%	2.26%	0.15%	0.17%	0.16%
Slope	0.04%	0.25%	0.06%	0.17%	0.20%	0.19%
Widow	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Yellowtail	1.05%	7.13%	1.71%	0.24%	0.28%	0.27%

Table 23. Total estimated catch and discard by vessel for non-directed tows in the arrowtooth EFP fishery.

Total estimated discard for non-directed tows

Species	A	B	C	D	E	F	G
			Flatfish				
Arrowtooth Flounder	37,235	6,702	6,944	1,413	7,157	8,742	2,926
Dover Sole	1,096	1,162	1,266	4,225	1,070	1,776	236
English Sole	918	959	51	859	133	1,771	74
Flathead Sole	-	360	1,128	2,926	-	849	-
Halibut	16,455	2,341	4,019	6,563	12,738	1,026	2,749
Other Flatfish	376	-	8	-	-	38	-
Petrale	1,786	5,359	380	2	5,079	16,576	4
Rex Sole	58	504	688	1,020	163	896	87
Sanddab	1,887	-	471	-	-	1,134	-
Sand Sole	192	-	-	-	-	10	-
Sub-Total	60,003	17,386	14,954	17,009	26,340	32,816	6,076
			Rockfish				
Canary	791	-	213	52	353	-	-
Darkblotched	-	15	-	-	-	-	-
POP	7	-	481	3	1	-	3
Shortspine Thornyhead	862	197	582	-	0	1	22
Shelf	4,451	-	2,788	1,040	513	129	451
Slope	77	39	-	23	-	6	45
Widow	-	-	-	-	-	-	-
Yellowtail	1	-	3,326	-	2,082	-	-
Sub-Total	6,189	252	7,390	1,118	2,949	136	521
			Roundfish				
Lingcod	3,265	383	298	1,344	1,384	334	158
Pacific Whiting	146	723	2,003	-	968	748	73
Sablefish	123	4,339	794	7,808	1,136	25,776	303
Sub-Total	3,534	5,445	3,095	9,152	3,488	26,859	534
			Miscellaneous				
Dogfish	30907	79399	8125	11182	4263	13059	26854
Eelpout	0	3	206	0	0	0	0
Ratfish	148	185	1086	12	12226	14309	364
Sculpin	0	0	11	134	0	2	10
Shad	54	60	386	633	924	335	82
Skate	1705	967	2905	116	1849	2163	1966
Snailfish	0	0	0	0	0	0	0
Wolf-eel	0	0	0	0	0	0	0
Sub-Total	32814	80614	12719	12078	19261	29868	29275
			Crab				
Dungeness	0	0	0	0	0	0	96
Grand Total	102,540	103,697	38,158	39,356	52,038	89,678	36,502

Table 24. Total estimated catch and discard by vessel for directed tows in the arrowtooth EFP fishery.

Total estimated discard for directed tows

	Vessel						
Species	A	B	C	D	E	F	G
Flatfish							
Arrowtooth Flounder	10,505	7,021	20,790	21,436	20,288	14,692	18,497
Dover Sole	4,467	1,281	10,253	593	25,482	1,192	735
English Sole	31	-	248	-	1,818	926	773
Flathead Sole	600	1,574	-	181	-	5,242	-
Halibut	1,631	2,920	8,149	14,918	14,879	789	3,821
Other Flatfish	7,517	-	-	3	-	238	4
Petrale	337	-	460	0	5,967	10,985	17
Rex Sole	8,048	1,661	2,588	63	2,848	1,055	241
Sanddab	3	-	921	1	1,084	18	-
Sand Sole	-	-	-	-	-	19	-
Sub-Total	33,139	14,457	43,409	37,194	72,366	35,156	24,088
Rockfish							
Canary	1,111	-	14	-	40	-	-
Darkblotched	-	7	-	-	-	-	-
POP	-	-	3,761	140	1	-	131
Shortspine Thornyhead	1,394	212	451	23	1	4	89
Shelf	471	-	1,428	8	414	137	362
Slope	79	1,576	2,418	647	5	15	992
Widow	-	-	-	-	-	-	-
Yellowtail	0	-	2,876	-	1,729	-	-
Sub-Total	3,057	1,794	10,947	819	2,189	156	1,575
Roundfish							
Lingcod	-	-	-	-	-	7	-
Pacific Whiting	-	-	-	-	-	-	-
Sablefish	-	-	-	1	5	-	-
Sub-Total	-	-	-	1	5	7	-
Miscellaneous							
Dogfish	985	2327	10969	2992	32107	17118	19226
Eelpout	0	0	187	20	0	162	4
Ratfish	7623	117	2469	59	12594	1402	887
Sculpin	0	0	33	0	0	29	2
Shad	29	0	45	499	225	61	1508
Skate	401	352	6906	1153	43264	3146	1514
Snailfish	0	0	3	23	0	0	4
Wolf-eel	0	0	0	38	0	0	0
Sub-Total	9038	2797	20612	4784	88192	21918	23147
Crab							
Dungeness	0	0	0	0	0	0	0
Grand Total	45,234	19,048	74,968	42,798	162,752	57,237	48,809

Table 25. Percent discard contribution by vessel for the arrowtooth EFP fishery.

Vessel Portion of total Forfeited and "0" Value Catch

Species	A	B	C	D	E	F	G
			Rockfish				
CNRY	73.9%	0.0%	8.8%	2.0%	15.3%	0.0%	0.0%
DBRK	3.3%	18.3%	57.5%	15.8%	0.0%	5.0%	0.0%
POP	0.2%	0.0%	93.7%	3.2%	0.0%	0.0%	3.0%
SSPN	58.8%	10.7%	26.9%	0.6%	0.0%	0.1%	2.9%
USLF	40.7%	0.0%	34.9%	8.7%	7.7%	1.4%	6.7%
USLP	2.6%	27.3%	40.8%	11.3%	0.1%	0.4%	17.5%
WDOW	-	-	-	-	-	-	-
YTRK	0.0%	0.0%	61.9%	0.0%	38.1%	0.0%	0.0%
	23.7%	5.2%	47.1%	5.0%	13.1%	0.5%	5.4%

Table 26. Comparison of unmarketable catch between vessels.

Fish Ticket Landing Data for "0" Value Catch

Species	A	B	C	D	E	F	G
			Flatfish				
ARTH	3,190	6,432	19,010	21,818	8,864	5,890	17,377
DOVR	5	419	14	-	12	-	63
EGLS	-	-	-	-	10	-	-
OFLT	-	-	8	3	8	-	-
PTRL	-	-	-	2	25	-	-
REX	-	-	-	1	9	-	-
RSOL	-	-	-	-	-	-	-
SSOL	8	-	4	1	66	-	-
Sub-Total	3,203	6,851	19,036	21,825	8,994	5,890	17,440
			Rockfish				
CNRY	-	-	-	-	-	-	-
DBRK	4	22	-	19	-	6	-
POP	7	-	20	16	2	-	-
SSPN	1,256	396	387	23	1	5	111
USLF	92	-	209	23	52	27	-
USLP	156	54	219	366	5	21	-
WDOW	-	-	-	-	-	-	-
YTRK	1	-	-	-	5	-	-
Sub-Total	1,516	472	835	447	65	59	111
			Roundfish				
LCOD	-	-	-	-	-	14	-
PCOD	-	-	-	-	9	-	-
PWHT	-	-	12	-	65	-	-
SABL	-	-	-	1	17	-	-
Sub-Total	-	-	12	1	91	14	-
			Miscellaneous				
DSRK	415	177	1,625	393	326	-	949
OCTP	-	-	-	-	-	-	-
SKAT	-	-	-	-	-	-	-
SSRK	-	-	-	-	-	-	-
MISC	-	-	-	-	67	-	-
Sub-Total	415	177	1,625	393	393	-	949
Grand Total	**5,134**	**7,500**	**21,508**	**22,666**	**9,543**	**5,963**	**18,500**

Table 27. Comparison of forfeited catch among vessels.

Fish Ticket Data for Forfeited Catch

Species	A	B	C	D	E	F	G
			Flatfish				
ARTH	-	-	-	-	-	-	-
DOVR	-	-	-	-	-	-	-
EGLS	-	-	-	-	-	-	-
OFLT	-	-	-	-	-	-	-
PTRL	-	-	-	-	-	-	-
REX	-	-	-	-	-	-	-
RSOL	-	-	-	-	-	-	-
SSOL	-	-	-	-	-	-	-
Sub-Total	-	-	-	-	-	-	-
			Rockfish				
CNRY	1,903	-	226	52	393	-	-
DBRK	-	-	69	-	-	-	-
POP	-	-	4,222	127	-	-	134
SSPN	1,000	13	646	-	-	-	-
USLF	4,831	-	4,007	1,025	875	141	813
USLP	-	1,561	2,199	304	-	-	1,037
WDOW	-	-	-	-	-	-	-
YTRK	-	-	6,202	-	3,806	-	-
Sub-Total	7,733	1,574	17,571	1,509	5,074	141	1,984
			Roundfish				
LCOD	-	-	-	-	-	-	-
PCOD	-	-	-	-	-	-	-
PWHT	-	-	-	-	-	-	-
SABL	-	-	-	-	-	-	-
Sub-Total	-	-	-	-	-	-	-
			Miscellaneous				
DSRK	-	-	-	-	-	-	-
OCTP	-	-	-	-	-	-	-
SKAT	-	-	-	-	-	-	-
SSRK	-	-	-	-	-	-	-
MISC	-	-	-	-	-	-	-
Sub-Total	-	-	-	-	-	-	-
Grand Total	**7,733**	**1,574**	**17,571**	**1,509**	**5,074**	**141**	**1,984**

Table 28. Monthly or bi-monthly trip limits on selected species for trawl gear in 2001.

Trip limits for limited entry trawl gear on selected species

Species/Species Group	Jul-Aug	Sep-Oct
Lingcod	400 lbs / month	400 lbs / month
Sablefish	11,000 lbs / 2 months	11,000 lbs / 2 months
Slope Rockfish	1,500 lb / 2 months	1,500 lb / 2 months
Shelf Rockfish	1,000 lbs / month	1,000 lbs / month
Canary Rockfish	300 lbs / month	300 lbs / month
POP	2,500 lbs / month	2,500 lbs / month
Yellowtail Rockfish	15,000 lbs / 2 months	15,000 lbs / 2 months

Figures

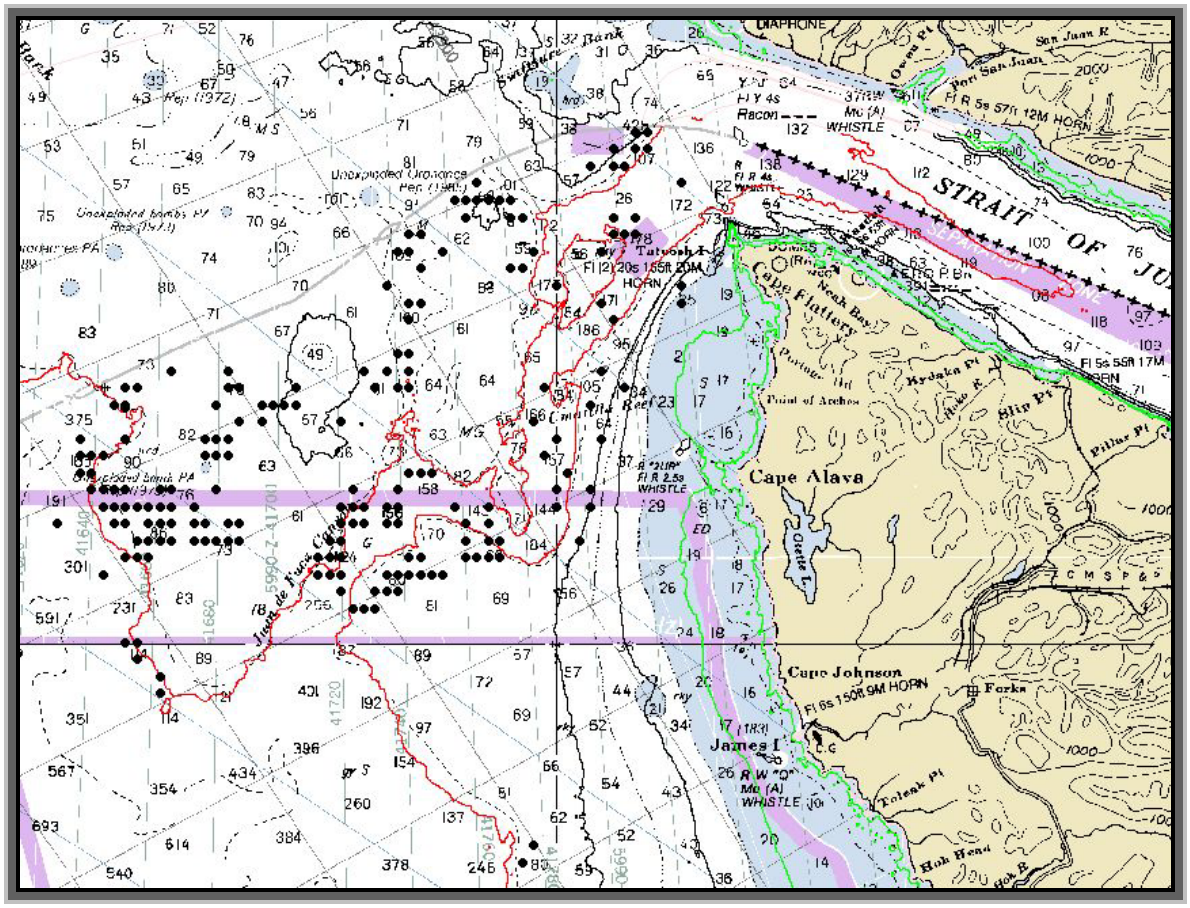
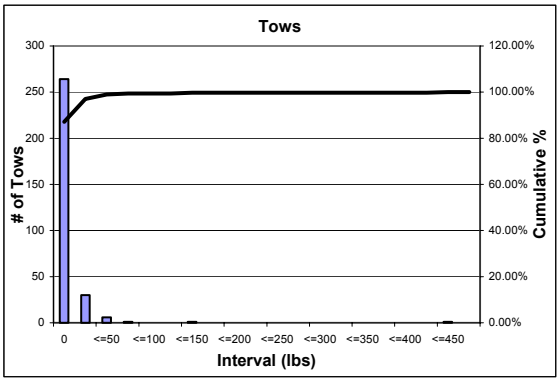


Figure 1. Tow locations for arrowtooth EFP fishery.

Tow Frequency Report for Hailed Catch in Successful Directed Arrowtooth Tows

Canary Rockfish Interval lbs	Tows	Percent	Cumulative Tows	Cumulative Percent	Weight (lbs)	Percent	Cumulative Weight	Cumulative Percent
0	264	87.13%	264	87.13%	0	0.00%	0	0.00%
25	30	9.90%	294	97.03%	246	21.43%	246	21.43%
50	6	1.98%	300	99.01%	232	20.21%	478	41.64%
75	1	0.33%	301	99.34%	70	6.10%	548	47.74%
100	0	0.00%	301	99.34%	0	0.00%	548	47.74%
125	0	0.00%	301	99.34%	0	0.00%	548	47.74%
150	1	0.33%	302	99.67%	150	13.07%	698	60.80%
175	0	0.00%	302	99.67%	0	0.00%	698	60.80%
200	0	0.00%	302	99.67%	0	0.00%	698	60.80%
225	0	0.00%	302	99.67%	0	0.00%	698	60.80%
250	0	0.00%	302	99.67%	0	0.00%	698	60.80%
275	0	0.00%	302	99.67%	0	0.00%	698	60.80%
300	0	0.00%	302	99.67%	0	0.00%	698	60.80%
325	0	0.00%	302	99.67%	0	0.00%	698	60.80%
350	0	0.00%	302	99.67%	0	0.00%	698	60.80%
375	0	0.00%	302	99.67%	0	0.00%	698	60.80%
400	0	0.00%	302	99.67%	0	0.00%	698	60.80%
425	0	0.00%	302	99.67%	0	0.00%	698	60.80%
450	1	0.33%	303	100.00%	450	39.20%	1148	100.00%
500	0	0.00%	303	100.00%	0	0.00%	1148	100.00%
Total	**303**				**1,148**			



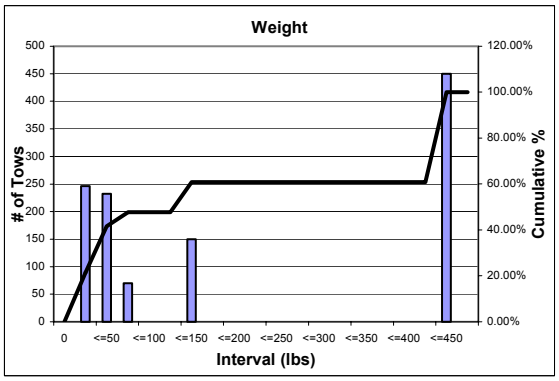
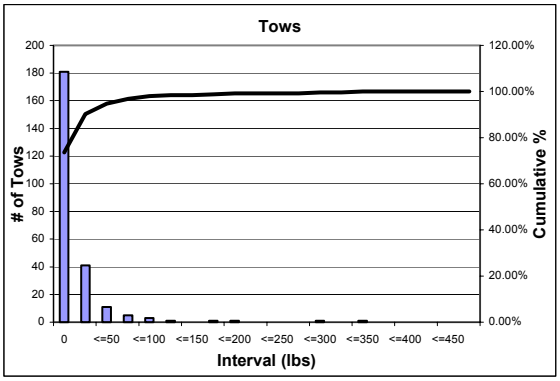


Figure 2. Tow frequency and hailed canary catch in directed tows.

Tow Frequency Report for Hailed Catch in Successful Non-Directed Arrowtooth Tows

Canary Rockfish Interval lbs	Tows	Percent	Cumulative Tows	Cumulative Percent	Weight (lbs)	Percent	Cumulative Weight	Cumulative Percent
0	181	73.58%	181	73.58%	0	0.00%	0	0.00%
<=25	41	16.67%	222	90.24%	377	14.75%	377	14.75%
<=50	11	4.47%	233	94.72%	443	17.33%	820	32.08%
<=75	5	2.03%	238	96.75%	336	13.15%	1156	45.23%
<=100	3	1.22%	241	97.97%	300	11.74%	1456	56.96%
<=125	1	0.41%	242	98.37%	110	4.30%	1566	61.27%
<=150	0	0.00%	242	98.37%	0	0.00%	1566	61.27%
<=175	1	0.41%	243	98.78%	160	6.26%	1726	67.53%
<=200	1	0.41%	244	99.19%	200	7.82%	1926	75.35%
<=225	0	0.00%	244	99.19%	0	0.00%	1926	75.35%
<=250	0	0.00%	244	99.19%	0	0.00%	1926	75.35%
<=275	0	0.00%	244	99.19%	0	0.00%	1926	75.35%
<=300	1	0.41%	245	99.59%	300	11.74%	2226	87.09%
<=325	0	0.00%	245	99.59%	0	0.00%	2226	87.09%
<=350	1	0.41%	246	100.00%	330	12.91%	2556	100.00%
<=375	0	0.00%	246	100.00%	0	0.00%	2556	100.00%
<=400	0	0.00%	246	100.00%	0	0.00%	2556	100.00%
<=425	0	0.00%	246	100.00%	0	0.00%	2556	100.00%
<=450	0	0.00%	246	100.00%	0	0.00%	2556	100.00%
<=500	0	0.00%	246	100.00%	0	0.00%	2556	100.00%
Total	**246**				**2,556**			



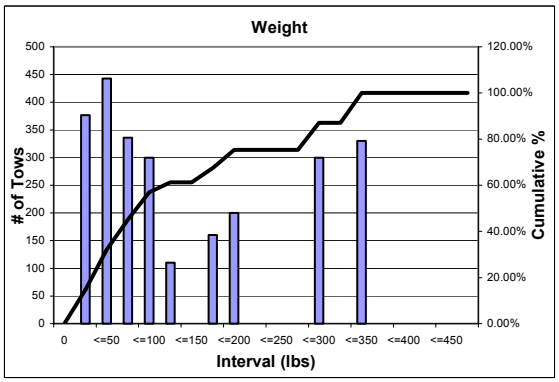


Figure 3. Tow frequency and hailed canary catch in non-directed tows.

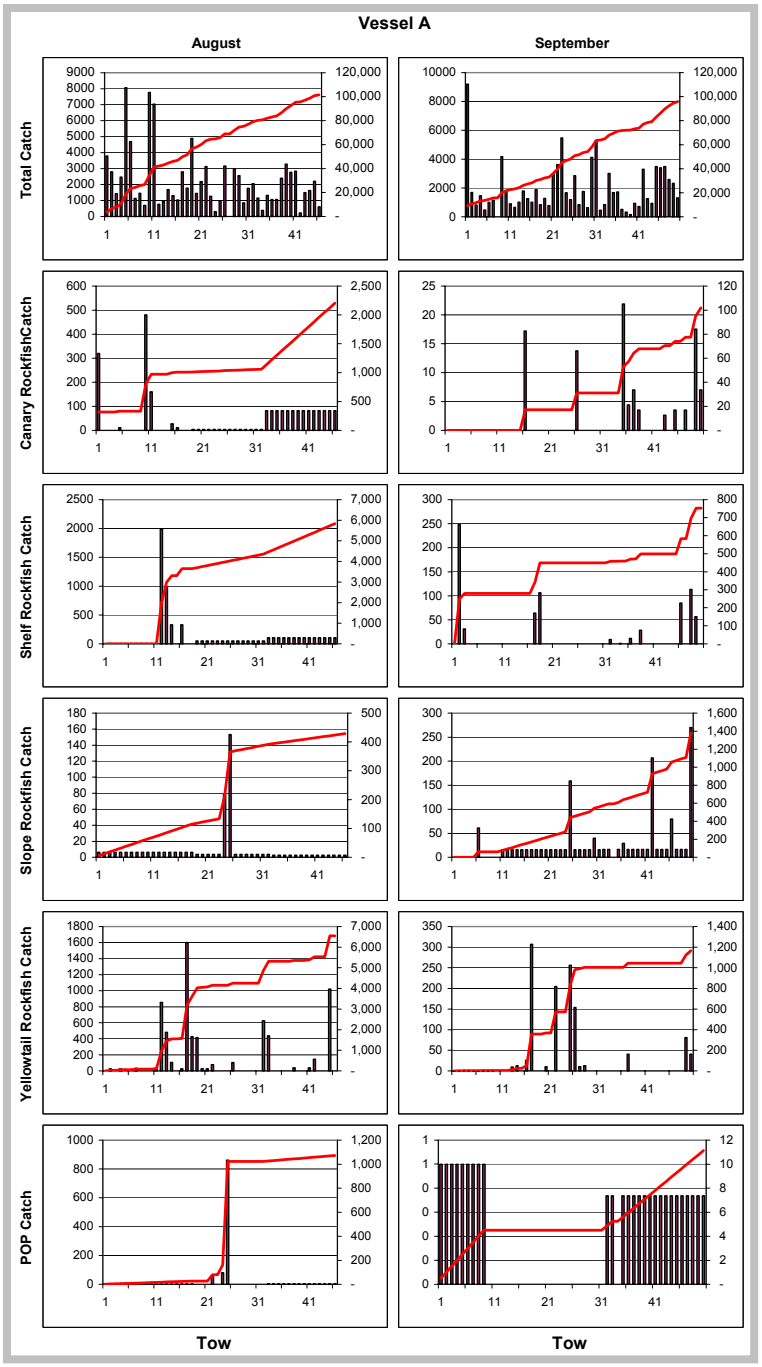


Figure 4. Tow specific catch for key rockfish species or species group for all tows by Vessel A during August and September.

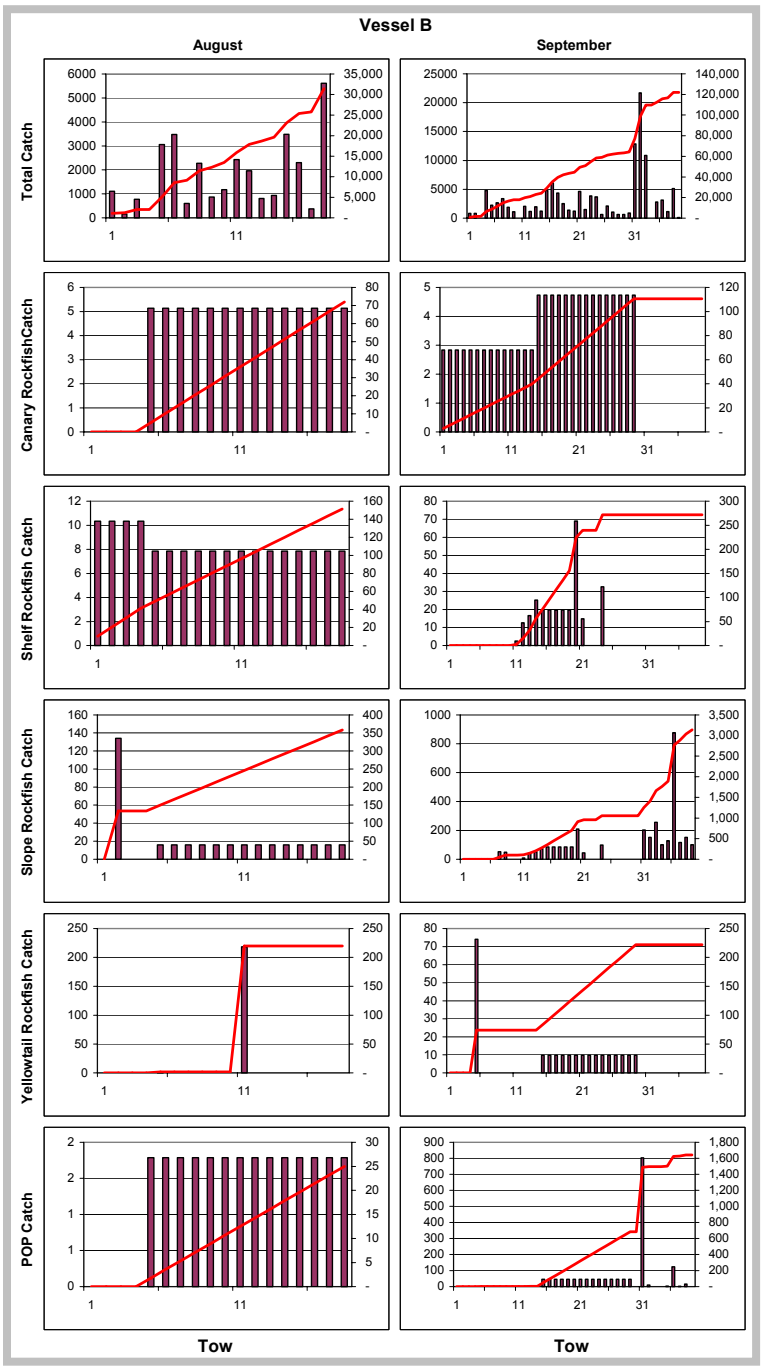


Figure 5. Tow specific catch for key rockfish species or species group for all tows by Vessel B during August and September.

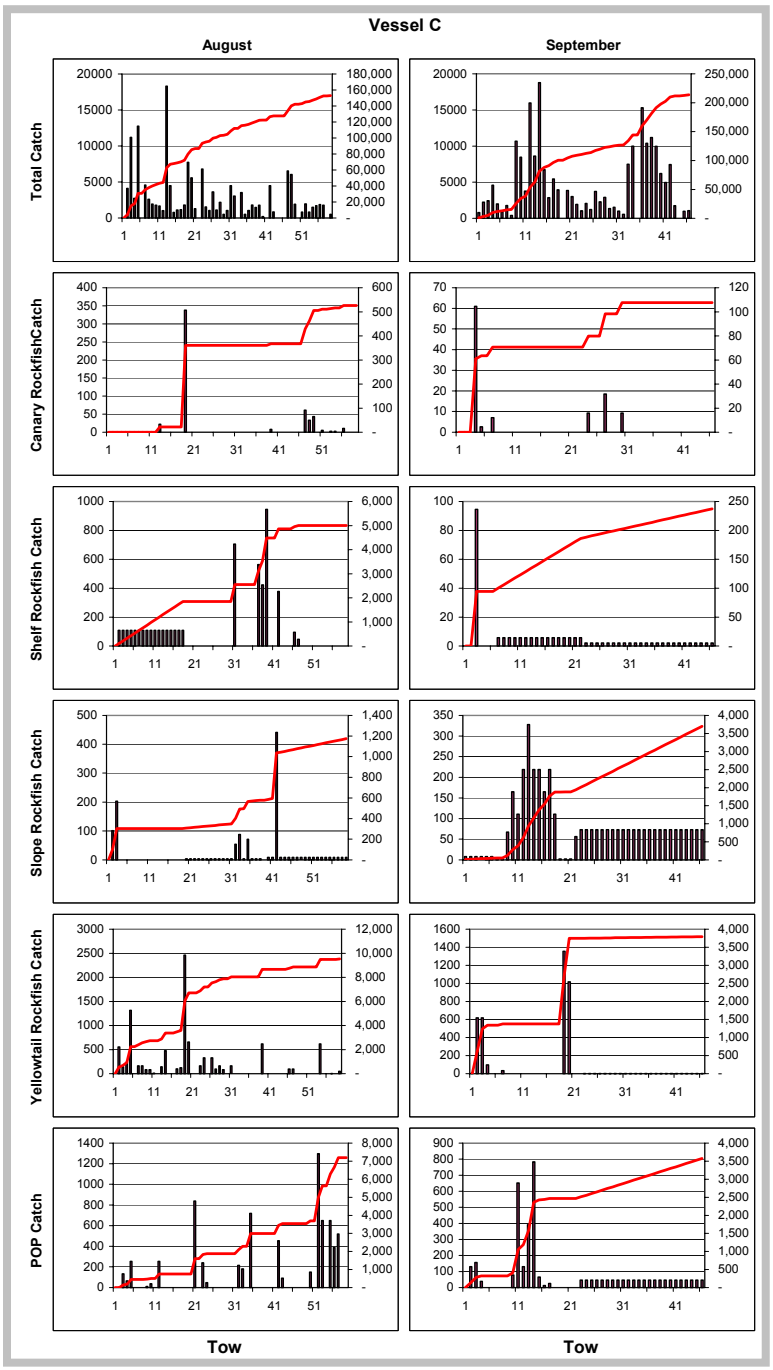


Figure 6. Tow specific catch for key rockfish species or species for tows by Vessel C during August and September.

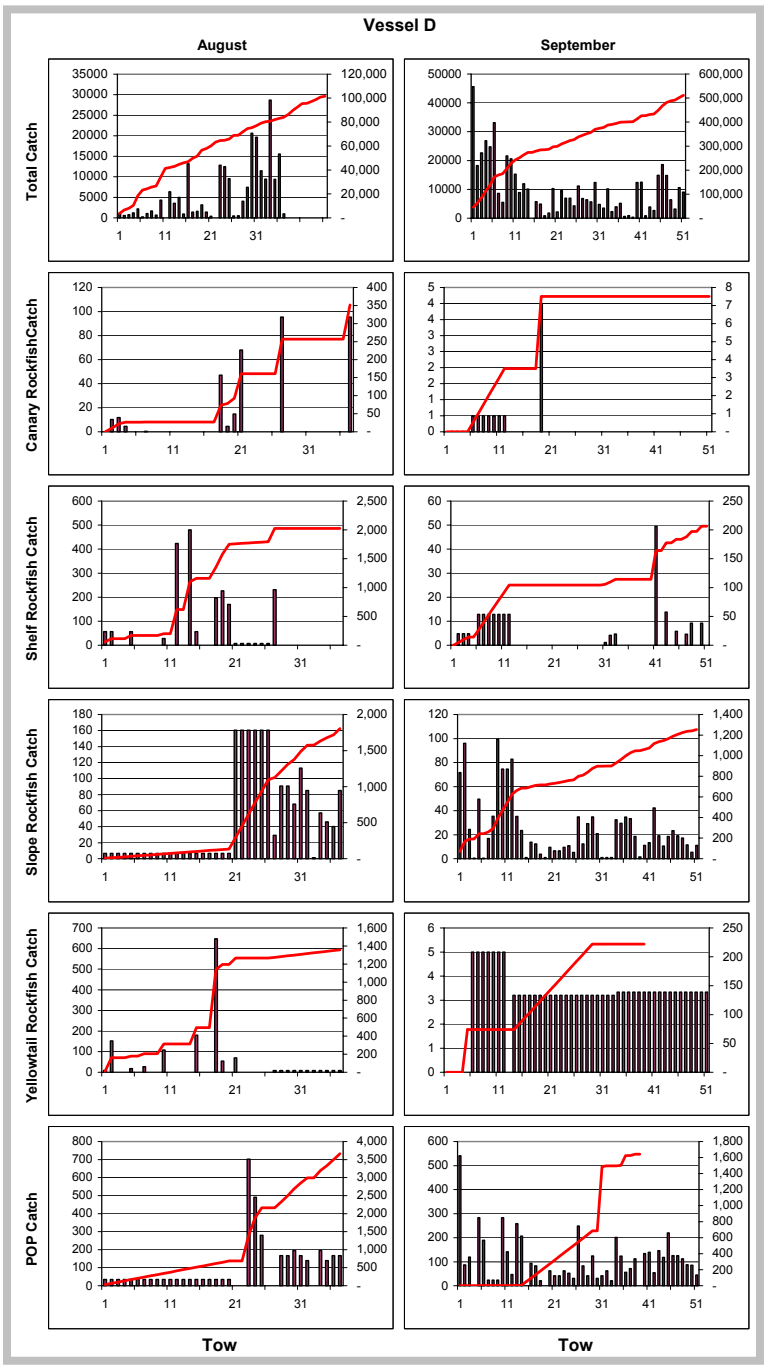


Figure 7. Tow specific catch for key rockfish species or species group for all tows by Vessel D during August and September.

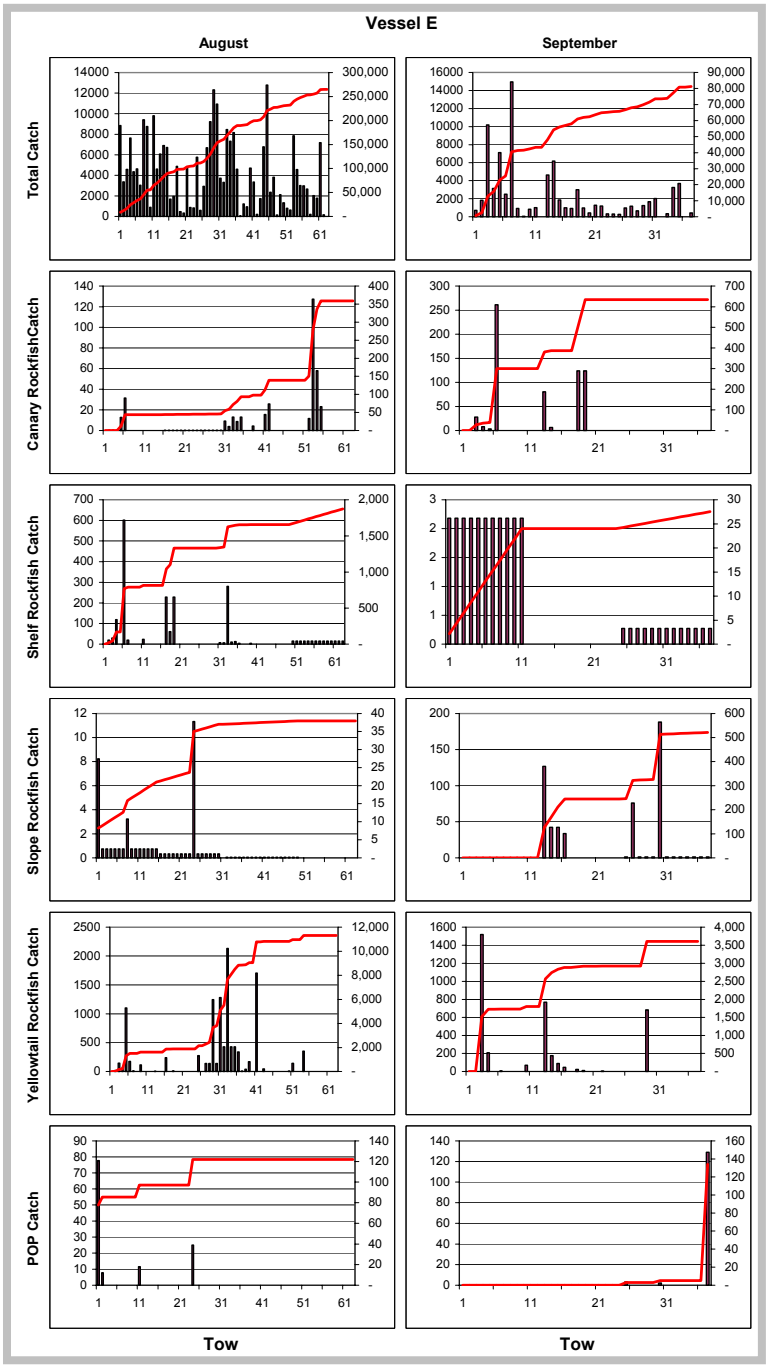


Figure 8. Tow specific catch for key rockfish species or species group for all tows by Vessel E during August and September.

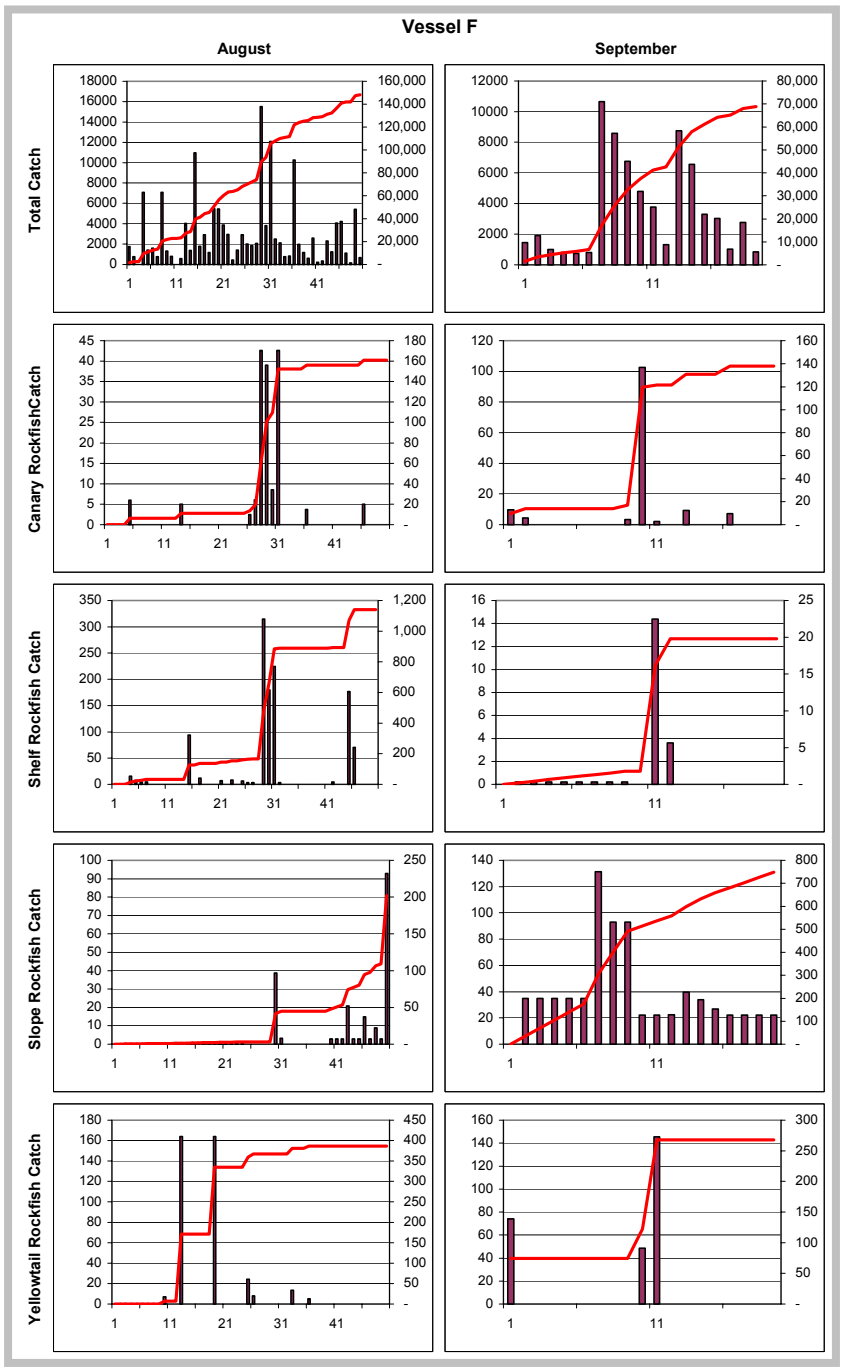


Figure 9. Tow specific catch for key rockfish species or species group for all tows by Vessel F during August and September.

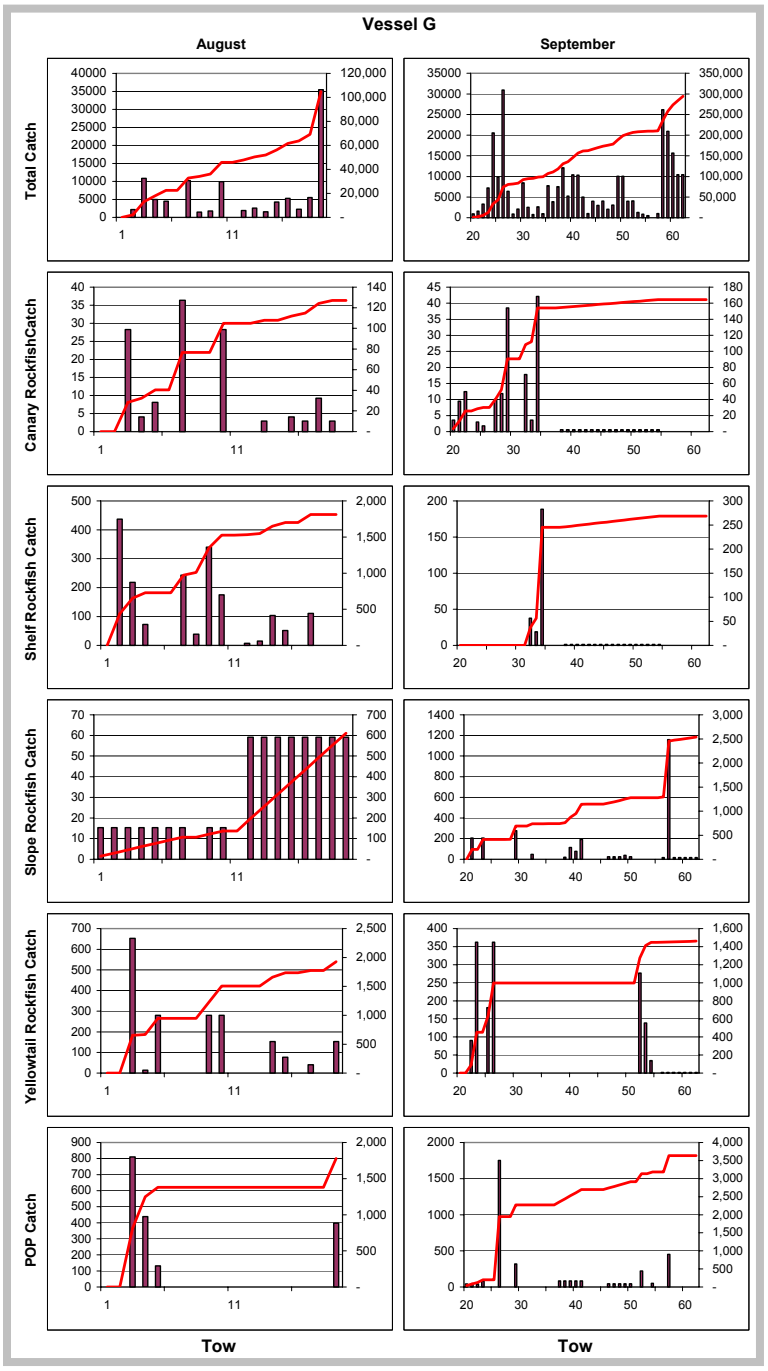


Figure 10. Tow specific catch for key rockfish species or species group for all tows by Vessel G during August and September.

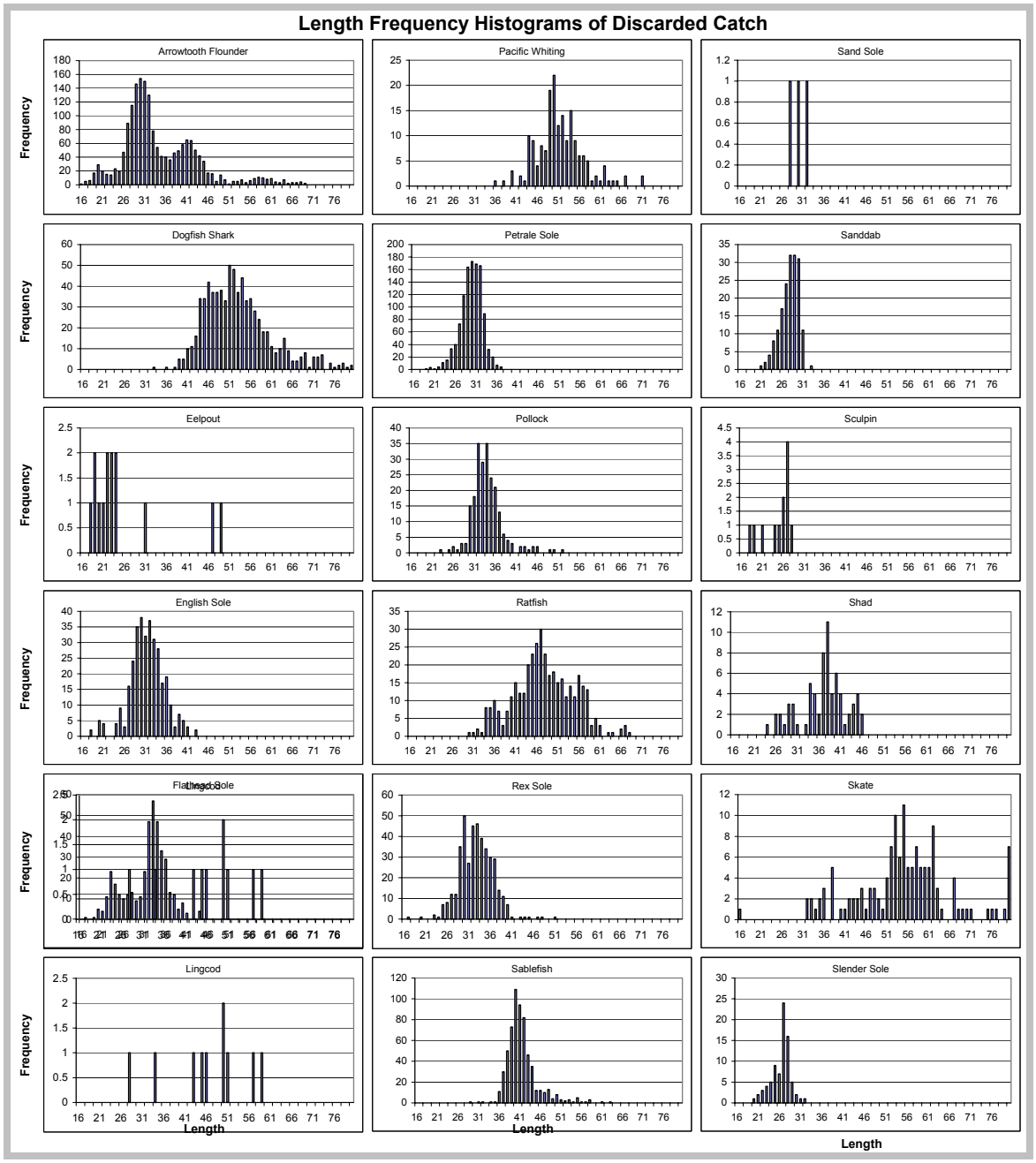


Figure 11. Length frequency plots of discarded catch.

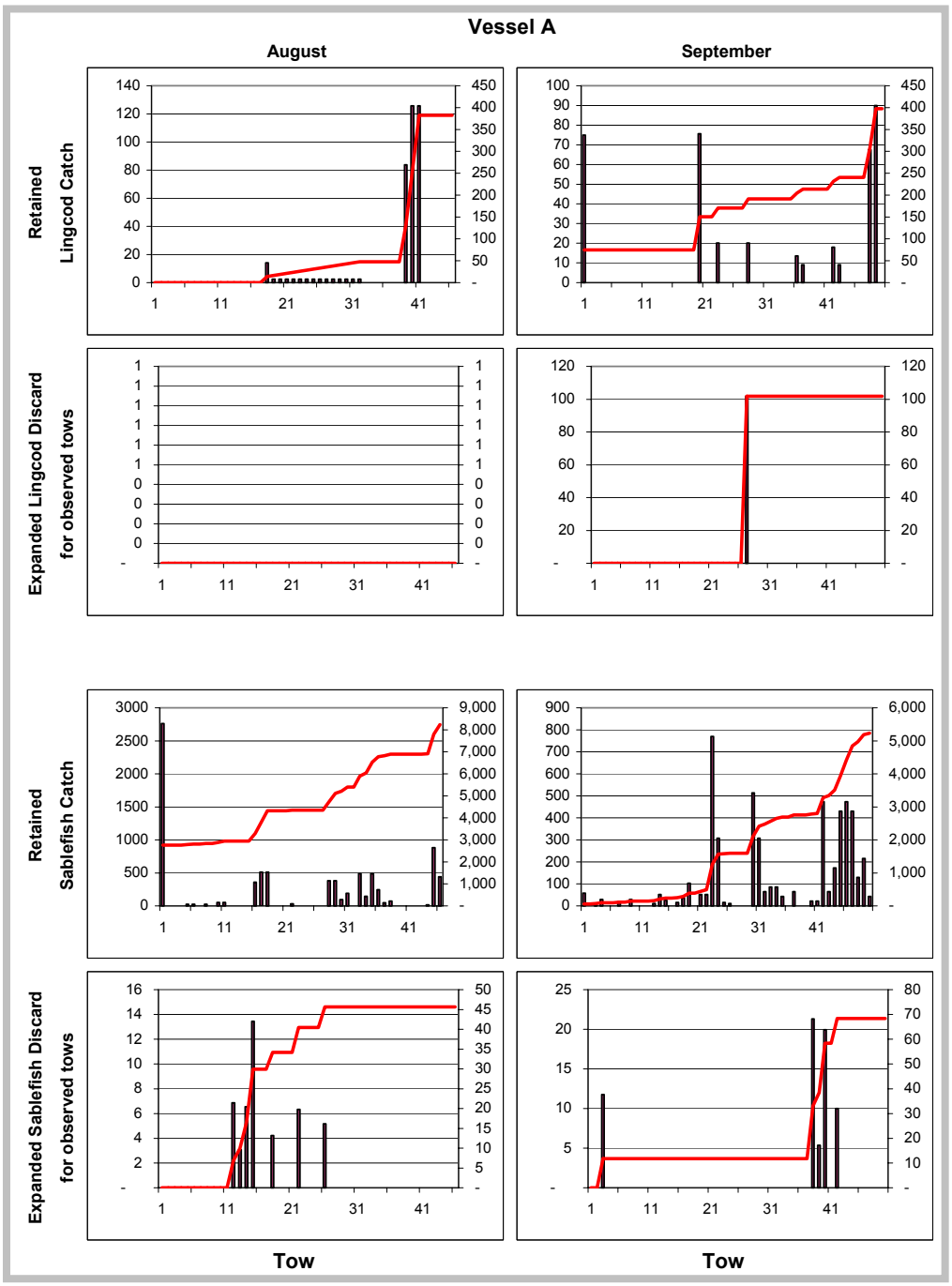


Figure 12. Fish ticket adjusted lingcod and sablefish catch (retained) by tow and expanded discard for observed tows for Vessel A in August and September.

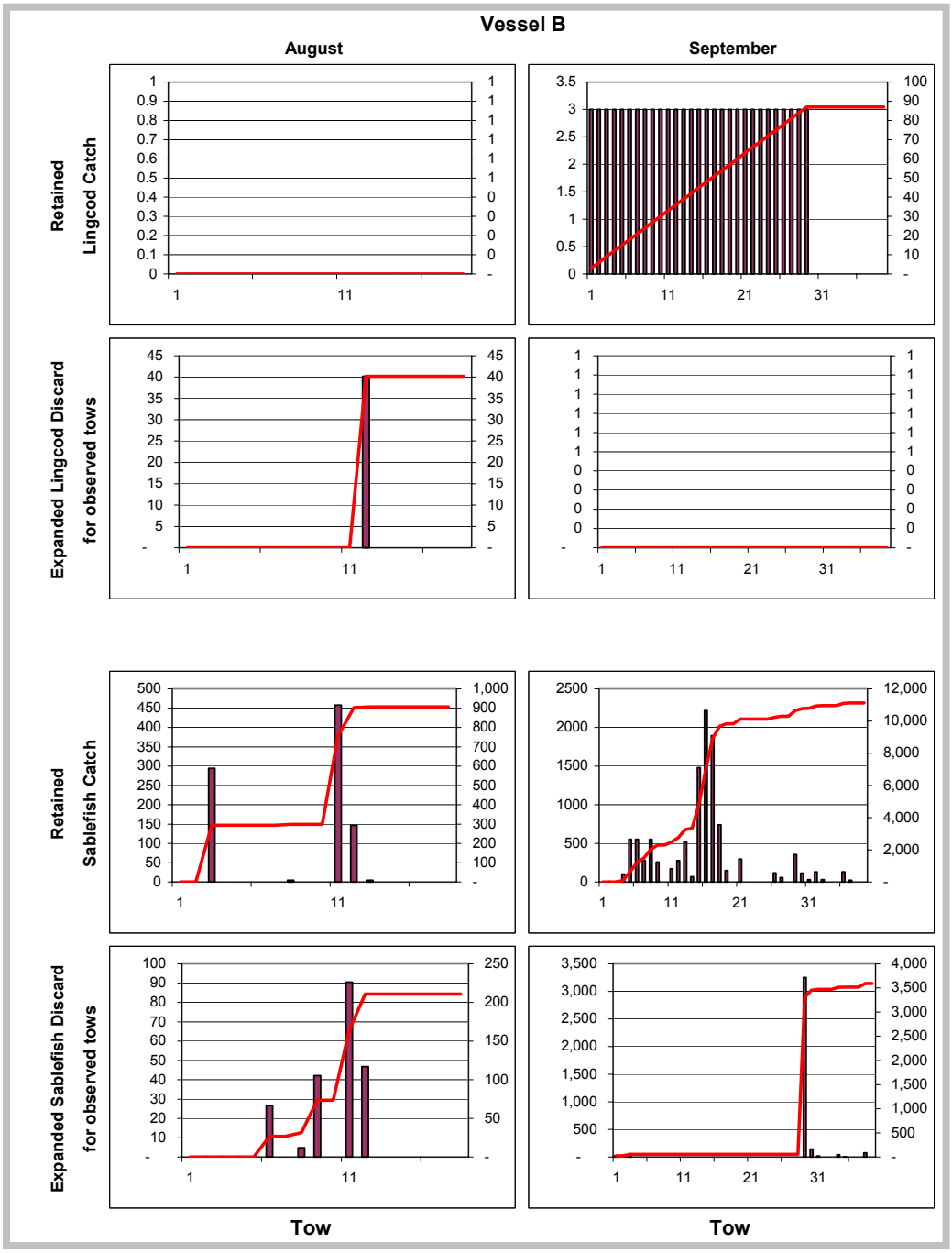


Figure 13. Fish ticket adjusted lingcod and sablefish catch (retained) by tow and expanded discard for observed tows for Vessel B in August and September.

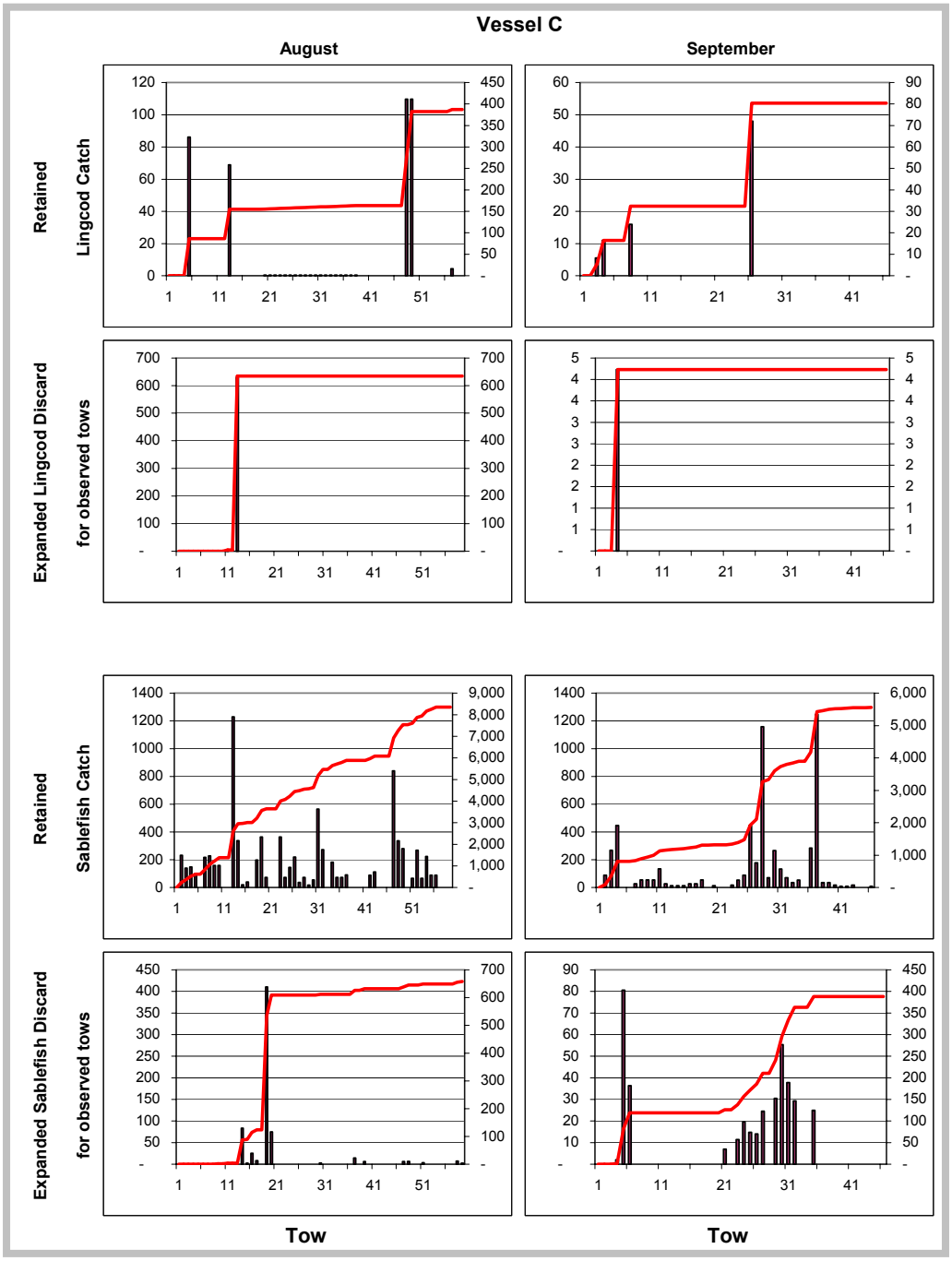


Figure 14. Fish ticket adjusted lingcod and sablefish catch (retained) by tow and expanded discard for observed tows for Vessel C in August and September.

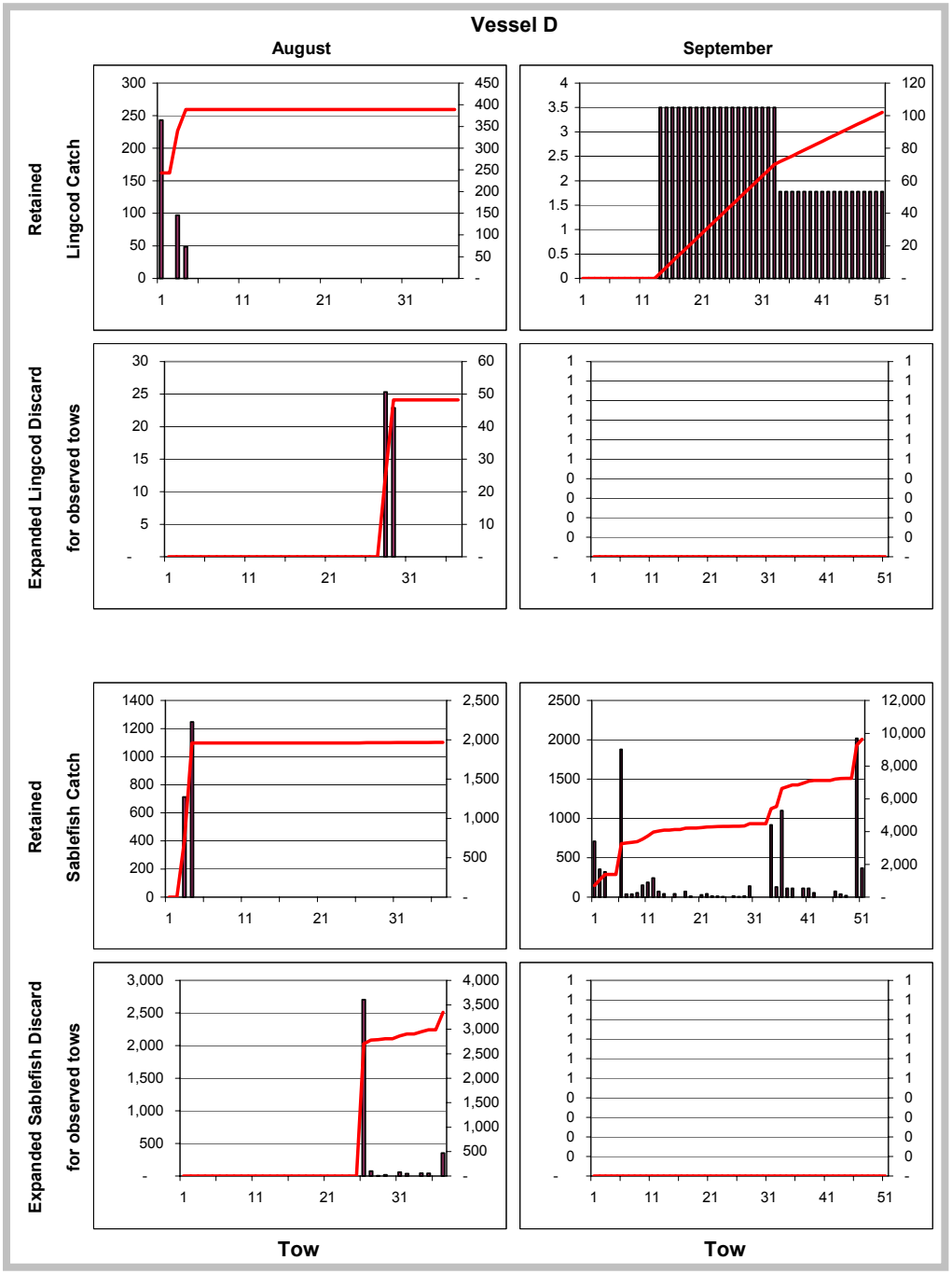


Figure 15. Fish ticket adjusted lingcod and sablefish catch (retained) by tow and expanded discard for observed tows for Vessel D in August and September.

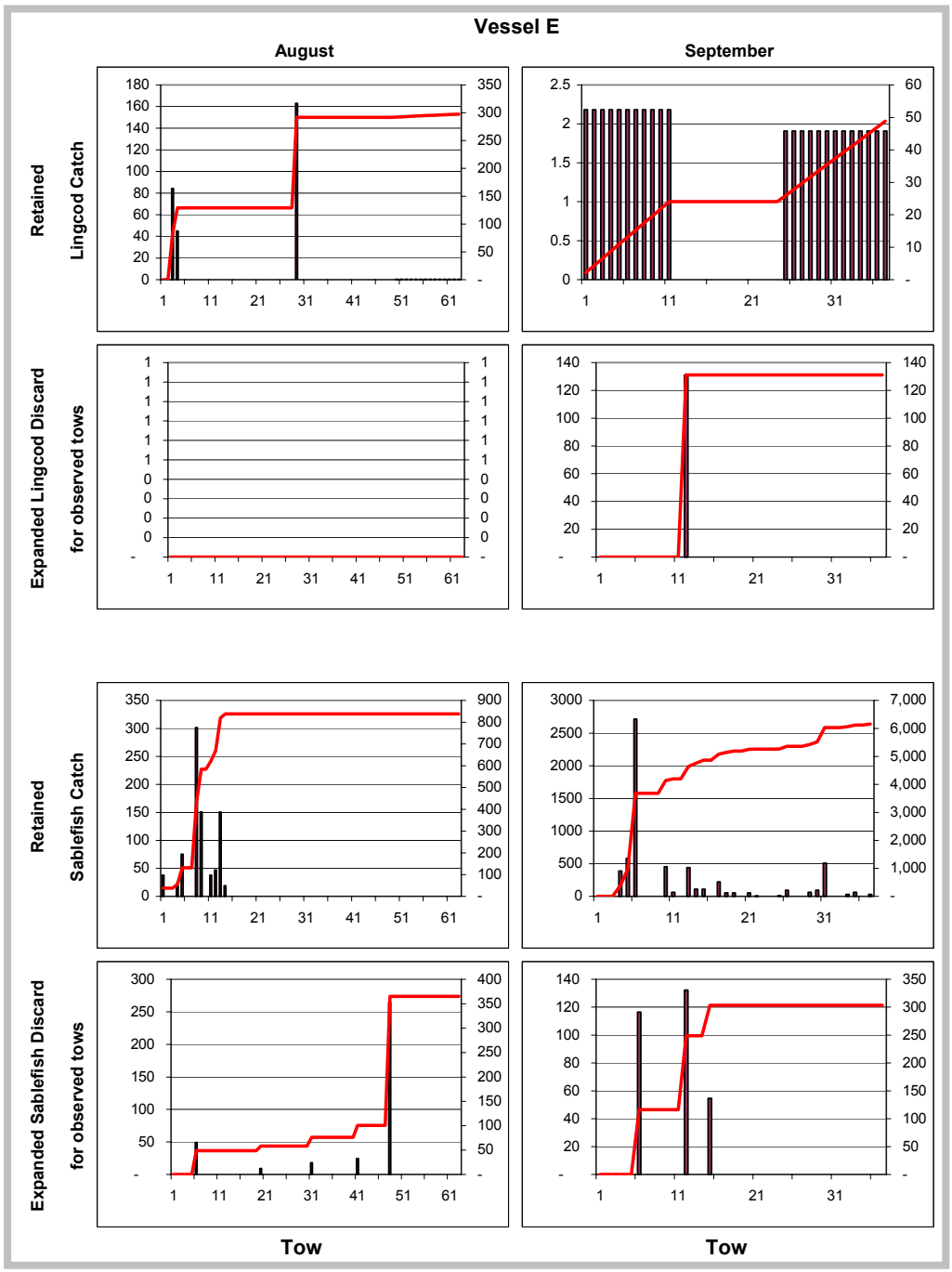


Figure 16. Fish ticket adjusted lingcod and sablefish catch (retained) by tow and expanded discard for observed tows for Vessel E in August and September.

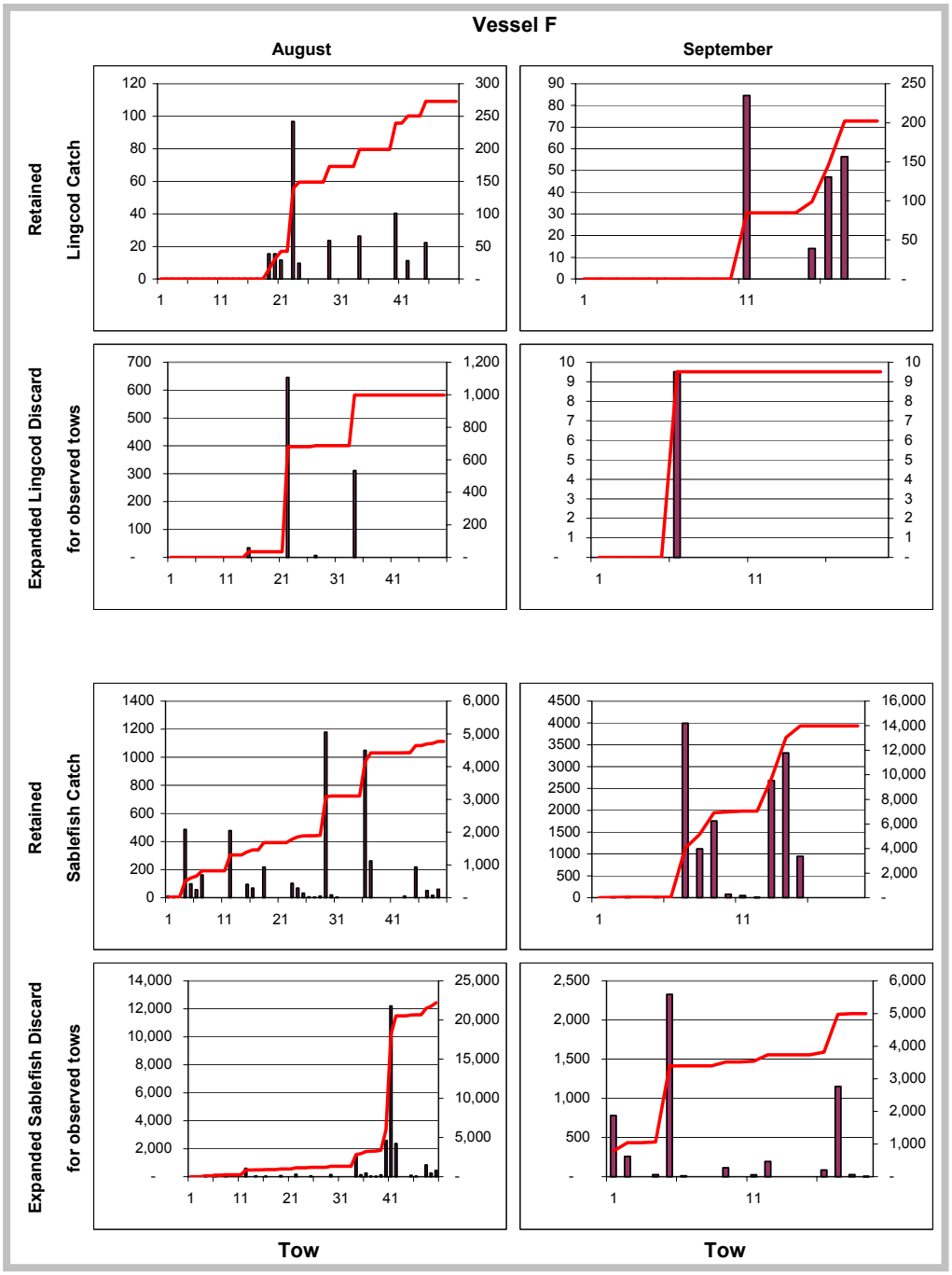


Figure 17. Fish ticket adjusted lingcod and sablefish catch (retained) by tow and expanded discard for observed tows for Vessel F in August and September.

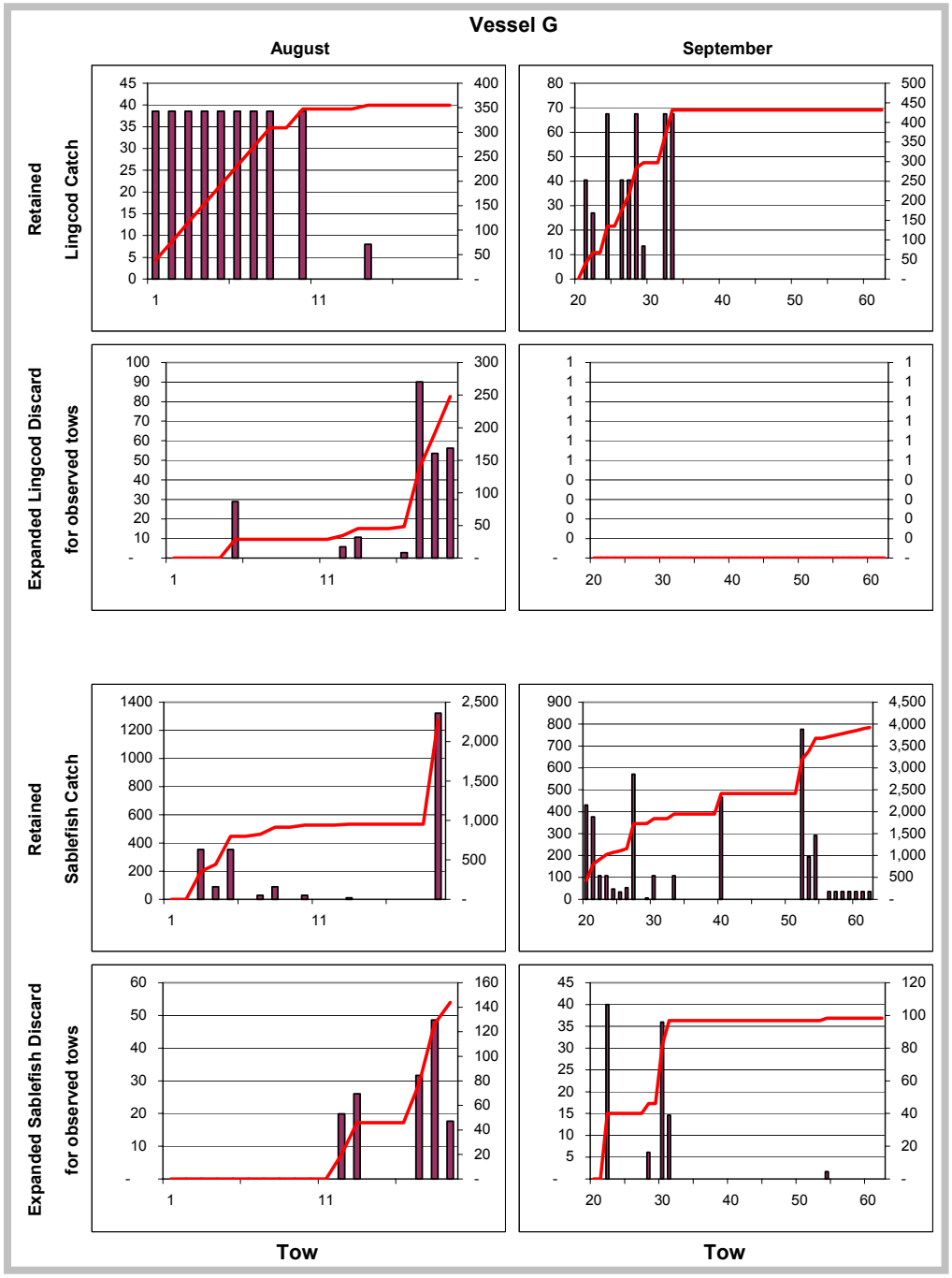


Figure 18. Fish ticket adjusted lingcod and sablefish catch (retained) by tow and expanded discard for observed tows for Vessel G in August and September.