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Status of 4VW American Plaice and Yellowtail Flounder

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Abstract

The 4VW flatfish management unit comprises three discrete components of American plaice and two discrete components of yellowtail flounder. Separate American plaice populations exist on Banquereau (4Vs) and in Sydney Bight (4Vn), and a transient Gulf of St Lawrence (4T) population may constitute a major but unquantifiable portion of the Sydney Bight fishery in the spring and fall. Both resident populations of plaice appear stable at low abundances, but it is not known if current fishing levels can be sustained. The migratory 4T component in Sydney Bight is at risk, based on 4T research vessel survey estimates, but we cannot track its' status in 4Vn. Yellowtail flounder populations can be discerned on Banquereau (4Vs) and Sable Island Bank (4W). The Banquereau fish are very tightly distributed near the southeast corner of the bank, and supported a fishery until 1996 when this component was fished out. The 4W yellowtail are widely dispersed and almost entirely of smaller sizes than taken by the fishery, suggesting that the region may serve as a nursery area. There is no indication of a serious fishery for yellowtail in 4W since the early 1970's.

American plaice exhibit strong trends of declining length at age and declining age at maturity, which has resulted in a large proportion of the stock attaining reproductive status prior to recruitment into the fishery. We believe this to be an evolutionary response to fishing pressure. The same phenomenon would likely be seen with yellowtail flounder if we had age data, based on parallels to plaice in length-weight-maturity trends. This may give these stocks a safety margin against over-exploitation, providing size restrictions are maintained. Less desirably, the trend will greatly diminish the potential yield of these stocks for the future.

Résumé

L'unité de gestion du poisson plat 4VW comprend trois stocks distincts de plie canadienne et deux stocks distincts de limande à queue jaune. Ainsi, des populations distinctes de plie canadienne existent sur le banc Banquereau (4Vs) et dans le Sydney Bight (4Vn). Une population migratoire dans le golfe du Saint-Laurent (4T) pourrait constituer une partie importante, mais non quantifiable, de la pêche de printemps et d'automne dans le Sydney Bight. Les deux populations résidentes de plie semblent stables mais les biomasses sont faibles si bien qu'on ne sait pas si la pêche peut être maintenue à son niveau actuel. Selon des estimations provenant de relevés scientifiques effectués dans la division 4T, la population migratoire 4T dans le Sydney Bight est en péril, mais on ne peut pas déterminer son état dans la sous-division 4Vn. Des populations de limande à queue jaune sont identifiées sur le banc Banquereau (4Vs) et le banc de l'île de Sable (4W). Les poissons du banc Banquereau, qui étaient pêchés jusqu'à l'épuisement de la population en 1996, se concentrent fortement près du coin sud-est du banc. Les limandes à queue jaune de la division 4W sont largement dispersées et presque toutes de taille inférieure à celle des limandes pêchées, ce qui porte à croire que le secteur sert de zone d'alevinage. Il n'existe aucune indication d'une pêche importante de la limande à queue jaune dans la division 4W depuis le début des années 1970.

La longueur selon l'âge et l'âge à maturité de la plie canadienne présentent de fortes tendances à la baisse, ce qui fait qu'une grande proportion du stock peut se reproduire avant d'être recrutée. Nous croyons qu'il s'agit d'une réaction évolutive à la pression de pêche. Selon les parallèles établis entre la limande à queue jaune et la plie canadienne en ce qui a trait à leurs tendances longueur-poids-maturité, le même phénomène serait sans doute observé pour la limande si l'on disposait de données d'âge pour cette espèce. Cela pourrait donner à ces stocks une marge de sécurité les protégeant contre la surexploitation, à condition que les limites de taille soient maintenues. Par contre, la tendance entraînera une forte baisse du rendement potentiel futur de ces stocks.

Introduction

American plaice (*Hippoglossoides platessoides*) and yellowtail flounder (*Limanda ferruginea*) are managed in NAFO area 4VW (Figure 1) as components of a flatfish species complex that also includes witch flounder (*Glyptocephalus cynoglossus*) and winter flounder (*Pseudopleuronectes americanus*). Witch flounder is assessed independently of the other flatfish species in this complex, and winter flounder are too sparse in 4VW to constitute a fishery.

The first TAC (total allowable catch) was established in 1974 at 32,000t for a 4VWX flatfish species complex consisting of American plaice, yellowtail flounder and witch flounder (Table 1). Winter flounder was not included in the TAC, probably due to the absence of foreign fishing pressure on this species. It is a predominantly inshore 4X stock fished mainly by Canadians. During the history of management of the flatfish complex, no attempt was made to segregate the TAC by species, as it was felt that the various flounder species were all reported as 'flatfish' or 'flounder', making identification implausible. In 1976 the TAC was reduced to 28,000t, and in 1978 the TAC was further reduced to 14,000t. The 1978 reduction coincides with the departure of most of the foreign fisheries from the Scotian Shelf (Table 2). In 1994 the TAC was reduced to 10,000t inclusive of winter flounder. Industry also supported the inclusion of winter flounder in the management complex. But winter flounder was never regarded as a component of the 4VW allocation. Since 1994 allocations have also been determined separately for 4X/5 and 4VW, and further partitioned by fleet sectors within regions. The geographic division was based on examination of biological parameters (Neilson, Stobo, Annand, unpublished), and a desire on the part of both Industry and Fisheries Management to control potential transfer of fishing effort between regions. The 4VW TAC on the combined American plaice/yellowtail flounder/witch flounder complex declined steadily from 5500t in 1994 to a low of 3,000t in both 1997 and 1998. The 1999 4VW TAC of 3,030t included an adjustment for a 15-month (January 1999 - March 2000) fishing season, as DFO converted the TAC period to reflect a fiscal year (April-March). The following 12-month TAC for the 2000/2001 fiscal year was 3000t.

Due to the paucity of age and length data from the commercial fishery, and the large proportions of landings not identified to species throughout most of the management history of Scotian Shelf flatfish stocks, it was never feasable to attempt sequential age-structured population analyses for these species. The first TAC was based on yield-per-recruit calculations (Halliday 1973), and subsequent TACs have been modified on the basis of research vessel biomass and catch rate estimates, commercial landings and catch/effort data, and concerns expressed by Industry participants about indications of decline in these fisheries. Witch flounder, although managed as part of the 4VW and 4X/5 flatfish complexes, has been assessed as a single species and single 4VWX stock since 1996, it being felt that sufficient price differential exists between witch and other flounders that witch flounder are usually identified to species. The 4X/5 flatfish complex of winter flounder, yellowtail flounder excluding Georges Bank (assessed separately as a transboundary stock), and American plaice was last assessed in 1997 (Stobo et al 1997). The 4VW American plaice and yellowtail stock components were last assessed in 1996 (Annand and Beanlands, 1996). This report examines the various traditional indicators of stock status (research vessel and landings data) for 4VW American plaice and yellowtail flounder, as well as revised landings data for 1992-1999 based on fishing log species identification, the 1999 catch-at-age structure for American plaice, and recent tagging results for releases of both plaice and yellowtail flounder in 4VW.

Description of the Fishery

Reported landings by country are given in Table 2. The catches reported by the USSR are based on species composition obtained from exploratory catches on 'scouting' vessels which were then used to partition total catch tonnage into species. Thus it is not possible to verify these catch values. Total reported landings of 4VW flatfish reached a historical low of 1974t in 1996, and

have since held fairly steady near 2000t per year through 1999 (Table 3). Witch flounder accounts for 20-25% of these landings, and unspecified flounder makes up 20-60% of the total. Quota monitoring to February 2, 2001 indicates 1837t for 1999 (Table 4). The annual catches reported in the quota management summary can be slightly higher (usually under 5% discrepancy) from those derived from the commercial landings database due to different reporting sources and editing procedures, indicating that the commercial landings of 1830t for 1999 were essentially complete by April, 2000.

Since 1994, when separate allocations of flatfish by fleet sector were initiated (based on historical catches), the offshore vessels > 100' have received the largest allocation, and the ITQ mobile fleet < 65' the second largest allocation. These two sectors combined represent about 90% of the allocation. Throughout the 1994-1999 period the offshore fleet never took more than 56% of their allocation (Table 4), so were never limited by flatfish quotas. In previous years about half the flatfish landings of this sector were bycatch in the cod fishery, so the flatfish catch by the offshore is probably constrained by season/area closures related to cod. The ITQ fleet, on the other hand, appears to have been restricted by its flatfish quota in every year (92% or more of the quota taken) until 1999, when only 72% of their quota was taken. Most of the shortfall between total catches and allocations is attributable to the offshore sector. The fixed gear fleet has been allocated about 200t every year since 1995 and never caught more than 5% of this. The mobile 65-100' and 4T/3Pn bycatch sectors are rarely allocated over 100t a year.

The unspecified flounder that has accounted for 18-50% of 4VW flatfish in the commercial landings since 1991, was reconciled against fishing log identification of species for Scotia/Fundy landings since 1992 (Fowler and Stobo, 1999). Table 5 compares the reported landings to the same 'adjusted' landings with instances of unspecified flounder replaced by named species where provided by the fishing log database. Differences in total landings between Table 3 and Table 5 (commonly around 100t, about 5% of the reported landings) are attributable to landings outside Scotia/Fundy, for which we do not have a fishing log database. The adjusted landings are characterized by proportions of unspecified flounder mostly in the 10-20% range, as opposed to the 20-50% range for the unadjusted commercial landings. The adjustments have the largest impact on our interpretation of American plaice landings. An increase in the importance of American plaice landings in 4VW is demonstrated by both data sources, but the magnitude of the change is much less extreme when viewed as adjusted landings. The catches of American plaice have probably risen about 40% since 1992, but they have not increased 20-fold as suggested by the commercial landings. The apparent dramatic increase in plaice catches would appear to be a facsimile of a trend of improvement in data quality (species identification) in the commercial landings since 1995.

Breakdowns of flatfish landings by species, fishing gears, locations and months are given in Tables 6 and 7, and Figures 2-5. Most of the Scotia/Fundy commercial landings of flatfish in 4VW since 1992, whether identified to species or not, are associated with detailed catch locations. Plottable landings represent 92-99% of these catches (the low of 92% relates to unspecified flounder). Interpretations of distribution by species are confused by changes in data processing over time - regional key pro-ration of species through 1990, little or no adjustment for species identification 1991-1992, identification by fishing logs since 1993 - nevertheless some broadscale changes over time can be discerned. Historically, American plaice and yellowtail flounder were fished predominantly by otter trawlers, with strong Danish seine and sometimes longline components, until the early 1990's. By 1993 the longline fishery no longer existed (much of this component represented bycatch when fishing cod, which was shutting down), and the Danish seiners had gained a clear prevalence over otter trawlers (again related to departures from the cod fishery). Since this time the fisheries have been roughly 2/3 Danish seine and 1/3 otter trawl, and are heavily prosecuted in 4Vn (Sydney Bight) during spring and summer, and southern 4Vs (mostly Banquereau) during the summer, but not in 4W. And since 1997 there has been a major fishery in 4Vn during the fall. There is very little fishing between Sydney Bight and Banquereau (sparse landings from large area centred around 4Vb). Much of these effort concentrations

involve the same boats, fishing a rough pattern of spring/summer in 4Vn, summer in 4Vs, and fall in 4Vn, and sometimes switching gear type from Danish seine to otter trawl when relocating from Sydney Bight to Banquereau. The fisheries in 4Vn are essentially just for plaice. The summer fishery in 4Vs focused on yellowtail over plaice until 1996, when yellowtail catches dropped markedly. There has not been a significant fishery on yellowtail since 1996, the current flatfish fishery throughout 4VW being primarily for American plaice.

In conjunction with downturns and closures of traditional fisheries (especially cod) in 4VW in the years prior to 1994, the historical status of flatfish as largely bycatch to other fisheries has changed drastically. Since at least 1994, when allocation of the flatfish TAC was first partitioned to fleet sectors, the fishery in 4VW has been characterized by almost solely directed fishing (Table 8), even when unspecified flounder was reported.

Species Distribution

American plaice

Summer research vessel (RV) surveys indicate that American plaice were always prevalent in Sydney Bight and Banquereau areas (Figure 6) where the fishery concentrates. Higher densities of American plaice in 4Vs relative to 4Vn are evident throughout the 1970's and 1980's, but more recent years of survey distribution suggest a trend of equalization across the region as previous areas of concentration have been diminished. Survey distributions throughout the 1990's are not reflected by the near-absence of a commercial fishery in the area between Sydney Bight and Banquereau (Figure 2). The distribution of pre-recruits (30cm or smaller) and fishery sizes (31cm or larger) of American plaice appears coincident (Figure 7a), the greater range (to the west) compatible with the greater abundance and dispersal of younger fish. The abundance of younger fish in 4W is evident throughout the RV time series, and thus cannot be attributed to the creation of the closed area.The density of fishery-sized fish, as measured by the proportion of non-zero sets (Figure 7b), has progressively declined since 1974.The commercial fishery has concentrated on 33-43 cm (mean 38-39 cm any year) fish since 1993.

Recoveries (Figure 9) through 1999 of plaice tagged in 4Vn during the summer of 1997 (Figure 8) show little movement outside the area of the Bight. Fisheries for American plaice adjacent to 4Vn, in 4Vs and eastern 4T, were active in all of 1997-99. This suggests that the summer residents of 4Vn are a local population, discrete from 4Vs plaice and discrete from any 4T spring or fall migrants.

Yellowtail flounder

During the 1970-84 period yellowtail flounder appeared to be continuously distributed over the southern portion of 4VsW (Figure 10). But as biomass declined two centres of abundance became evident, one quite localized near the southeast corner of Banquereau, and the other more dispersed over Sable Island Bank. The distribution of commercial landings by the fishery (Figure 3) only shows the concentration on Banquereau, tightly matched to the locus indicated by survey distributions. Most of the area of 4W that is associated with higher catches of yellowtail in RV surveys (largely Sable Island Bank) has been closed to trawlers since 1987. Fishermen report that even prior to 1987 this area was often avoided due to a prevalence of smaller fish than the market wanted. As can be seen from Figure 11a, yellowtail flounder west of Banquereau in recent years are almost entirely pre-recruits (30cm or smaller). The density of fishery-sized fish, as measured by the proportion of non-zero sets (Figure 11b), has progressively declined since 1979.The commercial fishery has concentrated on 31-37 cm (mean 33-34 cm any year) fish since 1993.

Tagging of yellowtail flounder in the two centres of concentration (4We, 4Vc) in 1998 has produced very few (13) recoveries, all from the Banquereau release and all local to the tagging location (see Figure 8). The absence of a fishery on 4Vs yellowtail since 1997, and the closure of 4We to trawlers, mitigates against recaptures. This may prove of benefit to determining the ultimate fate of the Sable Island Bank fish, since they will be left alone in the area of release, and thus we will only obtain recoveries if and when they move into adjacent fishing areas.

Unspecified flounder

After adjusting for species identification using fishing logs, most of the remaining unspecified flounder in 4VW since 1992 derive from the Banquereau fishery (Figure 4). As unspecified flounder continued to be caught on Banquereau after 1996, the last year we have any reason to consider yellowtail as a significant portion of the commercial landings (Table 5), it seems likely that most of the still-unspecified flounder since 1992 is American plaice.

Resource Status

The individual strata for which RV survey abundances are calculated are depicted in Figure 12. The management area for the stocks dealt with in this paper (4VW) comprises strata 40-42 (4Vn), 43-52 (4Vs), and 53-66 (4W). The vessel used to conduct the surveys was changed in 1983, which could affect relative catchability of flatfish species between 1970-1982 and 1983-1999 surveys. An intercalibration study (Fanning, 1985) indicates that surveys since 1983 may catch 30% less small plaice (28cm or smaller) and 20% less yellowtail flounder than pre-1983 surveys, but we do not make any adjustments to the data for earlier years.

Fishing effort data, based on the Scotia/Fundy adjusted commercial landings, was extracted for major fleet components of the 4VW flatfish fishery since 1992. Commercial catch rates (tons/hour) of sets with 50% or more plaice or yellowtail caught by dedicated fishers (known vessels directing for plaice in every year since 1992) were used to generate relative indices of abundance. Given the short time series available, we only use these catch rates as supporting evidence for interpretations of survey estimates. The catch/effort dataset is summarized in Table 9. For analyses of catch rates only the Danish seine fisheries were used, and only for those years in which at least 100 sets were made (hence no catch rate series for yellowtail flounder after 1996). A number of features of this dataset should be remarked upon:

1) The subset of the landings represented by this dataset accounts for the majority of the total Scotia/Fundy flatfish landings of either species.

2) The entire dataset only contains 28 boats. Nearly half (12) the boats are represented in both Danish seine and otter trawl fleet sectors.

3) Almost all the boats (20) fish both Sydney Bight and Banquereau (not always both areas in one year), and any boat fishing Banquereau will be represented in both plaice and yellowtail catch series.

Thus the Danish seine catch series analyzed are essentially just the same boats split off by area and species into three dataset subgroups.

American plaice

Summer RV estimates of numbers and weights per tow, and biomass estimates, are provided in Table 10 (unstratified mean numbers per strata; in cross-referencing Table 10 with Figure 12, note that each stratum number in Figure 12 is preceded with the number 4 in Table 10) and Tables 11a-c (stratified estimates). Overall numbers per tow show no clear trend throughout the 1990's, but there are strong differences in abundance trends of pre-recruits and fishery-sized fish. Most of the variability in these estimates derives from abundances of pre-recruits (Figure 13), and it is the abundance of these small fish that has maintained the overall abundance. No relationship between the abundance of pre-recruits and subsequent abundance of fishery sizes can be ascertained for American plaice, possibly due to the compression of multiple cohorts within single-centimeter lengths. This limits the predictive value of survey estimates to short-term prognoses based on the abundances of fishery-sized fish. The fishery-sized plaice exhibit a general decline since 1976, with a steady decline in abundance from 1989 to a record low in 1994. Since 1994 abundance estimates for the fishery-sized plaice have remained close to the record low, but have not declined further, possibly benefitting from closure of the cod fishery since 4VW in 1993. Erosion of the abundance of fishery sizes is also evident from the stratified weights per tow and mean weights (Figure 14), and length-frequencies (Figure 15) of these fish throughout the period. Differences in abundance trends between 4Vs and 4Vn are also evident, especially noticeable during a period of relative stability in 4Vn numbers in the 1980's while 4Vs numbers dropped sharply (Figure 13b).

Between 1978 and 1984 DFO conducted parallel seasonal RV surveys of Scotia/Fundy groundfish stocks in the spring, summer and fall (Table 12 provides the spring and fall results). The patterns in estimates between spring and fall surveys were very similar, while the summer survey bore no apparent relationship to the other surveys (Figure 16). Given the greater emphasis on spring, and in recent years spring and fall, fishing for American plaice over summer fishing, it may be questionable whether the summer survey tracks the same population(s) that are being fished. Unfortunately we don't have another survey time series for the stock since 1984 (the spring and fall surveys were cancelled). A currently active spring (March) survey in 4VsW (Table 13, Figure 17), is similar to the earlier Shelf-wide spring survey, but does not sample 4Vn. This is critical for plaice, since 4Vn alone represents roughly half the fishery, yet only averages 15% of the summer RV biomass estimate in 4V (comparing Tables 11b and 11c). The extremely low estimates of 4Vs plaice abundance throughout most of the March survey relative to the summer survey in concurrent years (Figures 17 and 18) also casts some doubt on the efficacy of the March sampling of this species. Industry sources maintain that flatfish in 4Vs are not available to fishing gear from about the third week of March until the first week of April, so abundance estimates may be confounded by the timing at which key strata are sampled from year to year. As well, the sudden drop in estimates coincides with the infusion of colder waters into the area (Simon and Comeau, 1994), suggesting that the change in temperature may have altered behavior patterns. Preliminary analyses of spring 4VsW RV survey catch rates in relation to temperature and week of sampling suggested that both these possible influences on survey estimates are relevant, and need to be examined in greater detail.

Given the divergences in summer RV abundance trends between 4Vs and 4Vn, and between summer and spring/fall surveys of 4Vn, and the disproportionate representation of 4Vn plaice in the 4VW fishery relative to summer RV biomass, described above, large portions of the spring and fall fisheries in 4Vn (see Table 7) may be 4T migrants. The most recent assessment of 4T American plaice (Morin et al, 1998) suggest that these components are in jeopardy. The RV estimates for 4T plaice had reached record lows for 1995-97.

It is indeterminate whether survey and commercial catch rates of American plaice (Figure 19; catch rates summarized in Table 14) show some correspondence or not. We do not have survey data for 4Vn in the spring during the 1990's, nor do we have sufficient 4Vn commercial fishery data during the summer, so could only compare spring commercial with summer survey catch rates in Sydney Bight. We do have reasonable data for both commercial and survey catch rates

in 4Vs during July since 1992. Unfortunately we could not distinguish between trends and variance in any of these time series.

A total 1,238 otoliths from the March 4VsW RV survey in 1999 were aged according to standards in Beanlands (1997). Calibration sessions on reference collection otoliths before and after aging the 1999 otoliths were characterized by coefficients of variation of 4.87 and 5.97 respectively, with no evidence of bias across ages.

Age:length data from 1988 July 4VW and 1999 March 4VsW survey samples suggests that, while we can see the erosion of larger fish from the stock over time, the age structure may have remained very similar (Figure 20). This interpretation is dependent on the assumption that aging of the two years of otoliths was done in a consistent manner[1]. We will assess that consistency by having the ager of the 1999 otoliths re-age the 1988 otoliths. Assuming no problem with aging techniques, it appears that the fish in 1999 are much smaller at age than the fish in 1988 (until about age 14, when they converge), such that the age distributions parallel each other (Figure 20a). This could imply that American plaice are evolving towards a smaller size, possibly a selective response to fishing pressure. The apparent health of these fish (condition factor), as surmised from predicted weights at length for 18-52cm fish (smallest through largest fish represented in all years), may have declined between the 1970's and 1980's (Figure 21), but no clear trends are evident since then. An associated trend in size at sexual maturity may have occurred as well. These trends precede the recent downturns in Atlantic fisheries and environmental fluctuations often associated with them, and were first noticed by Beacham (1983) in each of 4X, 4W, and 4T. Therefore they probably reflect a long-term genetic affect of fishing pressure. Historical literature (Bakken,1987) suggests an L_{50} (length at which 50% of the fish are mature) of 33 cm for 4X American plaice females from an unexploited population in St. Margarets Bay. These fish would have been 10-11 years old. Maturity data from summer RV surveys (Figure 22) indicates that the L_{50} was around 34 cm in 1970, and had declined to the 26-29 cm range by the late 1970's. Subsequent maturity data for 1980-85 shows no further trend, and we don't have more recent data to determine if the L_{50} has stabilized. Based on 1988 age:length data, the 1980-85 fish would have been around 5-6 years old at their L_{50} lengths. This has the obvious negative implication of reducing the yield potential for the species, but may provide a measure of safety for the survival of the population. Confirmation of the persistence of this trend beyond 1985 will require that maturity data be collected from RV surveys in the future.

To obtain some idea of possible trends in mortality between 1988 and 1999, we conducted a simple linear interpolation between the two age:length keys (Tables 15 and 16) to estimate keys for the intervening years. The catch at length for the 1993-1999 commercial fishery was approximated by taking the mean slope and intercept of the March RV length:weight equations for the last 4 years, and applying this averaged equation through commercial sampling length frequency data to estimate numbers at length caught by Danish seine and otter trawl fisheries (together comprise at least 95% of the landings for 1994-1999, 90% for 1993). This approximation would be compromised if there has been any trend in the length:weight relationship over time. A check on the validity of this approach was achieved by comparing estimated versus known commercial sample weights (Table 17). The length:weight equation will usually under-estimate the number of fish in a sample by a small amount, but no trend over time is apparent. Table 18 summarizes the commercial sampling data in relation to the commercial landings, and lists the 'bump factors' used to equate catch at length samples to their respective fisheries.

Applying the age:length keys to summer and March RV series (Table 19), and to the commercial fishery (Tables 20-22), gives a unique trend for every data source (Figure 23a). The mortality

[1] Consistency in aging methods between 1988 and 1999 was confirmed prior to completion of this document, but not in time for the Regional Assessment Process. Hence we retain the provisional wording of interpretations of age-related observations.

estimates from the RV data exhibit a consistent increasing trend over the time series, although varaibility in the estimates increases during the 1995-99 period. Most importantly, the commercial mortality estimates track differently between 4Vn and 4VsW - in 4 out of 6 years they trend in opposite directions. The unanimous drop in mortality estimates in 1999 across all data sources may indicate improvement in resource status, however the mortality estimate for the last year of a series is the least reliable. Note that loss of ambiguously located samples (e.g. 4VW, 4V) in some years makes minor changes (ignoring rounding errors) in the composite sample catch at length being applied to 4VW relative to those applied to 4VsW and 4Vn separately. Hence removals at a given length for 4VsW and 4Vn won't always add up to those for 4VW combined (i.e. 1993, 1996, 1999), due to the extra samples valid only with respect to 4VW as a whole. It must also be noted that the commercial mortality estimates will be under-estimated according to the amount of plaice represented as unspecified flounder in the adjusted landings, and that annual variations will be confounded by any changes in the relative proportion of plaice in the landings of unspecified flounder.

An extrapolation of the 1999 age:length key back through the years of the summer RV series, and calculation of relative fishing mortality (relative F = commercial catch/fishery-sized biomass) was required for inclusion in a 'Traffic Light Table', used to summarize stock status during the Regional Assessment Process. Figure 23 (b) provides a contrast of the interpolated and extrapolated mortality estimates resulting from the two age:length keys, as well as relative F. The patterns in total mortality since 1988 are similar, the extrapolated estimates just higher than the interpolated estimates throughout 1988-1992. Relative F has mostly increased since 1992. The trend in relative F may be a reasonable reflection of the pattern in fishing mortality, though both absolute and relative magnitudes will be confounded by the contribution of plaice to the unspecified flounder component of flatfish landings, as with commercial estimates.

Yellowtail flounder

Summer RV estimates of yellowtail flounder numbers and weights per tow, and biomass estimates, are provided in Table 23 (unstratified mean weights per strata; each strata in Figure 12 is preceded with the number 4 in the table) and Tables 24a-c (stratified estimates). Overall numbers per tow indicate a recent increase in abundance, but most of this is a result of pre-recruit abundance (see also Figure 24). As with American plaice, no relationship can be discerned between the abundances of pre-recruit and fishery sizes of yellowtail flounder, restricting the predictive value of survey estimates to short-term prognoses based on fishery-sized fish. These larger yellowtail (over 30cm) exhibit a general decline since 1974, to a record low in 1993. Since 1993, abundance estimates for the fishable sizes of plaice have remained close to the 1993 value. In 1996, when the commercial landings of yellowtail flounder dropped markedly, a new record low RV abundance of fishery-sized fish was reached. This loss of fishable sizes is also demonstrated by declines in stratified weights per tow and mean weights (Figure 25), and the RV length-frequencies of these fish throughout the period (Figure 26). To reflect the disparity in distribution between fishery and pre-recruit sizes of yellowtail flounder, we derived separate summer RV abundance estimates for 4Vs (Banquereau) and 4W (Sable Island Bank). The trends in abundance for the two regions both show the decline in abundance of larger fish (Figure 24b) but overall abundance trends, inclusive of pre-recruits, are quite different (comparing Figures 28a and b). The postulated nursery area in 4W showed a peak in numbers during 1990-1991 (Figure 28b) and subsequently declined through 1995. Numbers have since remained low. On Banquereau, however, abundance was very low between 1988 and 1994, and has since improved considerably. We know from Figure 24 that these trends are related to pre-recruit abundance, indicating that 4Vs contains a significant component of small fish. We don't know if this means that 4Vs abundance is independent of recruitment from 4W.

The parallel seasonal RV surveys of Scotia/Fundy groundfish stocks conducted between 1978 and 1984 (see Table 12 for spring and fall results) suggest that any of these surveys are adequate for tracking yellowtail flounder abundance. The trends in estimates between spring and summer surveys were correlated, and the fall survey tends to predict the spring and summer abundances for subsequent years (Figure 27). Assuming that the summer survey has continued to track this population since 1984, the current March 4VsW survey would not appear to be a reliable indicator of yellowtail flounder abundance (Figures 28 and 29), usually catching very few yellowtail, even in years when the summer survey abundance is high. As already discussed in relation to plaice, we will need to examine whether the March survey estimates of yellowtail flounder abundance are confounded by temperature or sampling effects.

Commercial and RV catch rates in 4Vs during July corresponded from 1992 through 1995 (Figure 30). After 1996 the magnitude of the yellowtail fishery was insufficient to provide catch rate estimates, and post-1996 RV survey catch rates reflect abundances of predominantly pre-recruit sizes of yellowtail flounder. Although the estimates of small fish seem to be maintaining, if not increasing in numbers since 1996, as yet this has not resulted in any contribution to the fishery-sized component of the population. Exhaustion of the fishery-sized portion of the yellowtail stock on Banquereau has effectively terminated this fishery at present, but the population may be safeguarded to some extent by the smaller fish around Sable Island Bank and the closed area in 4W. A bigger concern will be future recruitment.

Yellowtail flounder east of Georges Bank have not been aged since 1983, and we have insufficient length:weight data to properly depict trends over time (Figure 31). Nevertheless, the available data indicate a decline in condition factor (predicted weights at lengths derived from 19-44cm fish, representing the smallest through largest fish represented in all years) between the 1970's and 1980's is evident for larger fish, similar to that observed for plaice. Length at maturity exhibited a decline during the 1970's (Figure 32), but we are unsure what has happened since then. Sparse sampling necessitated that we combine 4Vs and 4W to estimate length at maturity, and numbers were still low with regard to estimates of L_{50} (with an associated high variability), so length at full maturity (95% or more mature) was determined as well (much higher numbers of fish sampled in these length ranges). The L_{100} declined from 34 cm in 1970 to 29 cm by the 1980-85 period, beyond which we have no maturity data. We don't know at present if this trend may have continued (the phenomenon has been observed for other species, and commonly bottoms out at some point), and need more recent data to resolve the issue. If length at maturity at least remained in the 25-29 cm range, then the bulk of the fish may become reproductive prior to recruitment. This would offer some protection to the stock in addition to the 4W closure, and would help to explain the divergence in abundance trends between fishable and pre-recruit sizes of yellowtail. However, the practical consequences for the fishery may be less optimistic. Given the smaller size of yellowtail flounder, they have greater potential than plaice to evolve reduced long-term yields. Collection of age and maturity data from RV surveys will be necessary to fully resolve the current status of yellowtail flounder.

Calculation of relative fishing mortality, as described for plaice, could only be attempted for yellowtail flounder since 1994(Figure 33) due to absence of individual weight data from the summer RV survey for earlier years (to derive the biomass of fishery-sized yellowtail). This provides only three years of estimates for an active fishery (1994-1996); as insufficient numbers of yellowtail flounder of marketable sizes were available to support a directed fishery after 1996, and thus estimates of F are extremely low. It is questionable whether fishing mortality estimates in the absence of a significant fishery (1997-1999) should be interpreted.

Traffic Light Tables

An attempt to apply the Precautionary Approach to evaluations of stock status, the Traffic Light Table seeks to quantify all relevant indicators of stock condition with a common scale, and integrate information across indicators into single values for each year as an overall stock status indicator. The intent is to provide an objective interpretation of the various indicators of stock condition, reducing the potential for biasing concensus in favor of particular indicators that may under- or over-emphasize some aspect of stock condition. The current version for 4VW American plaice (Figure 34) and yellowtail flounder (Figure 35), incorporated into a Stock Status Report (DFO, 2000), arbitrarily categorized each yearly value of an indicator as good, intermediate, or bad (green, yellow, red in traffic light parlance) based on the difference between the yearly value and the overall mean of the time series. For indicators of fish abundance, the threshold point for a bad (red) classification was set at under 60% of the mean, while that for a good (green) classification was set at the mean. All intermediate values were classified as indeterminate (yellow). For indicators of fish condition or spatial distribution/density, the three categories were attributed according to percentiles (lowest, middle, highest thirds of values assigned bad, indeterminate, or good ratings respectively). For mortality estimates, any value under the mean was regarded as good, while any value over 140% of the mean was considered bad. The overall summary indicator value for each year was computed by coding each individual indicator as bad/red=1, indeterminate/yellow=2, good/green=3, then taking the mean of these values. The overall summary thresholds, used to classify the summary indicator as good, bad, or indeterminate, were calculated as 2 ± 25% of a random multinomial distribution of 1's, 2's and 3's. Values at or below the lower threshold are considered bad, values at or above the higher threshold are considered good, and those in between are considered indeterminate. The indeterminate (yellow) region between thresholds widens with declining numbers of indicators (a multinomial distribution was separately estimated for each unique number of indicators).

The Traffic Light table for American plaice portrays poor (in the red) stock status for most years since 1992 due to the low abundance (Research Vessel survey biomass estimates and area occupied) and poor condition of fishery-sized American plaice. Other indicators for American plaice (RV biomass of pre-recruits, RV total mortality, relative fishing mortality) presented generally intermediate impressions of stock status. The Traffic Light table for yellowtail flounder depicts poor stock status during the period leading up to the end of the fishery, followed by intermediate (yellow) stock status since that time. The more recent yellow status for yellowtail flounder is a result of mixed signals, with low abundance (Research Vessel survey biomass estimates and area occupied) of fishery-sized yellowtail flounder indicating poor stock status, while the high production of pre-recruits and low fishing mortality are good signs.

A concern with the form of classification applied to 4VW flatfish stocks was the use of arbitrary thresholds to define values as good, bad, or indeterminate. Without biologically-based boundaries to ascribe meaningful thresholds, a given traffic light for an indicator can only reflect the pattern of values relative to each other. It does, however, provide a convenient summary of the trends in every key indicator that can be visualized at one time, a useful tool to focus discussion during public review of an assessment. We expect that future versions of the Traffic Light Table will replace the arbitrary thresholds with more appropriate limits. Another concern, applicable to the Traffic Light approach in general and a subject of much debate, are the rationales of various methods of integration of indicators into single stock status summaries. We do not address this issue here. However, some problems with specific indicators in the plaice and yellowtail Traffic Light tables merit attention[2].

The indicators of fish condition presented in the Traffic Light tables for plaice and yellowtail were poorly estimated, predictions at weight being derived from growth equations using

[2] To ascertain the impact of the more problematic indicators in the original Traffic Light tables, we generated modified versions of the table (see Appendix) in which we have removed the indicators of pre-recruit abundance and relative fishing mortality, and replaced the fish condition series with corrected values.

all lengths in each year, as opposed to restricting the calculation to a common length range represented in every year. The former prediction can be influenced by changes in the presence or absence of particular lengths. This is demonstrated by American plaice, where loss of larger fish from the population resulted in complete disappearance of lengths from the RV data. A pronounced decline in the weight of 40cm plaice during the 1990's (to a record low in 2000) was predicted using all the data, whereas the same prediction using a common length range depicts only a slight decline to a little less than the mean condition for the time series. The mis-predicted trend had a large impact on the summary indicator.

Relative fishing mortality was incorporated into the Traffic Light table without considering that variations in the magnitude and proportions of the catch being reported as unspecified flounder would confound the estimates. In most years (all years for plaice) the absolute magnitude of the variation in the landings of unspecified flounder relative to prior and subsequent years exceeds the variation in the landings of plaice or yellowtail. As well, the proportion of unspecifed flounder relative to either plaice or yellowtail changed considerably over the period of time for which relative fishing mortality was estimated. We cannot properly quantify the extent to which changes in relative fishing mortality estimates are simply reflecting changes in species identification (catch reporting). However both have been trending up.

The use of pre-recruit abundance as an indicator of stock status usually pre-supposes a quantifiable relationship between the numbers of pre-recruits in one year and the number of fish recruiting to the fishery at some subsequent point in time. This has not been demonstrated for either of 4VW plaice or yellowtail, although the possibility remains that such a relationship will be established when sufficient acceptable age:length data becomes available to enable tracking of specific cohorts. Specific lengths for these species comprise too much overlap in ages for modal progression. Once we can reasonably allocate numbers at length to numbers at age over a time series, we hope to provide a revised indicator of pre-recruit abundance with thresholds based on a proven relationship between pre-recruit and recruit abundance. At present we do not know how to properly interpret the abundance of plaice and yellowtail pre-recruits with respect to stock status. Further complicating our perspective on this indicator is the absence of explicit management objectives for these stocks. We would regard pre-recruit abundance as a very dubious signal if our goal was to sustain profitable fisheries on these populations, but the indicator would attain great relevance if the goal was simply to sustain a viable population without concerning ourselves with fishery prospects. Typically, stock assessments have either addressed the various aspects of stock status independently, or have only used methods of integration where the management goal was clearly sustainable fisheries (analytical assessments such as sequential population analysis). In cases of independently treated indicators, it was implicitly left to fisheries managers to decide their relative import, with or without associated opinions of assessors. The Traffic Light approach necessitates that management objectives be formally defined, even in situations where arbitrary limits are still to be applied, in order to judge whether certain indicators should be included or excluded from consideration.

Industry Consultations

Discussions with some of the index fishermen from the catch rate series provided several insights into the plaice and yellowtail fisheries that may colloborate or explain aspects of this assessment. Key points of these discussions can be summarized as follows:

1. The abundance of market-sized yellowtail flounder declined throughout the 90's, in accord with trends in the summer Research Vessel surveys, commercial catch rates, and landings statistics.

2. No consensus on the status of American plaice.

3. The American plaice fishery in 4Vn is dependent on transient fish moving through the area in the spring and fall. This fits with our contention about the likely seasonal association between 4Vn and 4T plaice.

4. The area of sparse landings between Banquereau and Sydney Bank (Misaine Bank), not reflected by the apparent distribution of flatfish provided by Research Vessel surveys, was variously attributed to untrawlable bottom and/or too many crabs in the net.

5. The 1999 shortfall in landings by the ITQ fleet against the TAC (only took 72%) probably had to do with new or enhanced access to more valuable species than flatfish by many of the boats in this fleet, rather than unavailability of American plaice.

6. Yellowtail flounder in 4W were much smaller than elsewhere, even before the 1987 closure. They were fished until size restrictions excluded them from consideration.

7. Fishing for flatfish in the 'holes' is good until about the third week of March, when they leave the holes and disappear until about the first week of May. A group of boats got together one year to make a systematic attempt to find them during this period, without success, concluding that the fish must bury themselves in the sand or they would have found them. This aspect of flatfish behavior was discussed when comparing summer to March Research Vessel survey estiamtes.

8. The occurrences of unspecified flounder in the commercial landings are almost entirely due to transcription by the Dockside Monitors during call-in and weighout. Fishermen rarely mix flatfish species, since they haven't been priced the same in many years (e.g. plaice is worth 10 cents per pound more than yellowtail). The only circumstance under which different species are valued the same is if they are all below decent 'fillet' size, at which point the buyers won't recognize the difference between species.

9. The U.S. market for witch flounder, to which most of the landings of this species go, no longer exists. They only want plaice now. This represents a drastic change in the relative values of these two species which we will need to bear in mind.

Conclusions and Prognosis

The yellowtail flounder fishery on Banquereau has ceased to be commercially viable. The American plaice fishery on Banquereau continues, but this could change over the course of a single year with the existing effort potential, and we don't yet have adequate data to quantify safe harvest levels for this population. The same holds true for the local component of the Sydney Bight fishery. We can't directly estimate the status of the spring and fall fisheries in Sydney Bight, but we do know that any portions of these fisheries that are dependent on 4T fish could be in trouble.

A possible trend toward smaller size at age for American plaice, and younger age at maturity for both American plaice and yellowtail flounder, could afford some degree of protection to these populations. Perhaps they are not much at risk as reproductive units. However the same trend would limit the future yield potential for these stocks to greatly reduced levels relative to historical fisheries due to higher cumulative mortality on the pre-recruit component. As well, gains in survivorship due to reduced fishing mortality may be offset if smaller mature pre-recruits are subject to higher natural mortality than larger mature pre-recruits.

The management units for 4VW American plaice and yellowtail flounder do not reflect the existing stock components. American plaice are probably comprised of three discrete stock units – Banquereau, the Sydney Bight local population, and seasonal spring/fall contributions of Gulf of St Lawrence fish to the Sydney Bight fishery. For management purposes, a major issue for plaice is resolving the quantitative representation of Gulf plaice in Sydney Bight over time. We can probably track the local and Banquereau components with existing data sources, but we do not yet have adequate data to predict future abundance. Yellowtail flounder may consist of two discrete components - the Banquereau group we associate with the fishery, and the Sable Island Bank group characterized by smaller fish. Yellowtail flounder in 4W are not currently accessible to fisheries, and could likely be kept out of future fisheries by size restrictions even if the closed area is opened. Of concern for yellowtail will be estimating any relationships between 4W pre-recruit abundance and 4W, 4Vs (and maybe 4X) recruitment.

Conservation of flatfish resources as sustainable directed fisheries would require separate TACs for each species. The current practice of allocating TACs for combined flatfish is unnecessary, given that the individual species are subjected to independently dedicated fishing effort. The current management system of a TAC based on the combined estimated resource status allows the industry to concentrate on any component or species in the complex rather than spreading the effort based on relative species abundance, and risks the survival of component populations. The different fisheries, in terms of species and locations, have been well established and described since 1993 (see Fowler and Stobo, 1999), and allow for discrete species allocations according to stock management areas. Potential still exists for fishery landings to be described in the commercial landings database as ‘unspecified flounder’ and thereby undermine separate TACs in the future. Preliminary results for the 1999 landings suggest that the trend of improvement in data quality observed during the mid-1990s may have stopped, or even reversed. Success of moving to individual species TACS will be dependent on enforcing administrative procedures to ensure species identification in the official statistics. This can only be reliably achieved by requiring complete species identification by the Dockside Monitoring Program.

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Table 1. History of total allowable catches (TAC) set for the Scotian Shelf management area for winter flounder, American plaice, yellowtail flounder and witch flounder.

YEAR(S)	ANNUAL TAC (t)	MANAGEMENT AREA	SPECIES
1974 - 75	32,000	4VWX	plaice, yellowtail, witch
1976 - 77	28,000	4VWX	plaice, yellowtail, witch
1978 - 93	14,000	4VWX	plaice, yellowtail, witch
1994	10,000*	4VWX/5Y	winter flounder, plaice, yellowtail, witch
	* partitioned between 4X/5Y (4,500t allocated as 3,000t for winter flounder and 1,500t for plaice, yellowtail and witch) and 4VW (5,500t, all allocated as plaice, yellowtail and witch since winter flounder is not fished to any extent in 4VW).		
1995	7,500*	4VWX/5Y	winter flounder, plaice, yellowtail, witch
	* partitioned between 4X/5Y (3,375t) and 4VW (4,125t)		
1996	6,875*	4VWX/5Y	winter flounder, plaice, yellowtail, witch
	* partitioned between 4X/5Y (3,375t) and 4VW (3,500t)		
1997	6,000*	4VWX/5Y	winter flounder, plaice, yellowtail, witch
	* partitioned between 4X/5Y (3,000t) and 4VW (3,000t)		
1998	5,000*	4VWX/5Y	winter flounder, plaice, yellowtail, witch
	* partitioned between 4X/5Y (2,000t) and 4VW (3,000t)		
1999/2000 (15 months)	5,350*	4VWX/5Y	winter flounder, plaice, yellowtail, witch
	* partitioned between 4X/5Y (2,320t) and 4VW (3,030t)		
2000/2001 (12 months)	5,000*	4VWX/5Y	winter flounder, plaice, yellowtail, witch
	* partitioned between 4X/5Y (2,000t) and 4VW (3,000t)		

Table 2. Canadian and foreign NAFO Reported Landings in metric tons for 1961-94 4VW flatfish.

	AMERICAN PLAICE				WINTER FLOUNDER				YELLOWTAIL FLOUNDER				UNIDENTIFIED FLATFISH			
Year	Canada	USSR	Other	Total	Canada	USSR	Other	Total	Canada	USSR	Other	Total	Canada	USSR	Other	Total
61	1358	0	26	1384	138	0	0	138	2908	0	0	2908	209	28	0	237
62	1455	0	30	1485	127	0	0	127	3479	0	0	3479	89	667	1	757
63	1958	84	17	2059	82	0	0	82	3759	129	0	3888	0	0	0	0
64	2503	4	63	2570	31	0	0	31	5231	18	0	5249	0	0	194	194
65	5253	2148	103	7504	134	76	1	211	5295	584	1	5880	0	0	90	90
66	8666	4791	23	13480	60	29	0	89	3712	973	0	4685	0	0	30	30
67	9579	82	3	9664	42	0	0	42	4956	15	0	4971	0	0	0	0
68	8961	9246	112	18319	13	25	0	38	5204	7708	11	12923	0	0	17	17
69	8485	4304	76	12865	4	12	0	16	2383	1242	0	3625	0	0	2	2
70	5725	1889	109	7723	10	42	0	52	735	2614	7	3356	0	0	9	9
71	7088	6647	21	13756	12	1588	1	1601	825	728	4	1557	0	0	0	0
72	6379	3553	155	10087	32	597	0	629	853	439	29	1321	33	0	10	43
73	4873	7140	80	12093	271	864	0	1135	303	1013	58	1374	1	0	175	176
74	6664	9581	69	16314	570	1212	0	1782	378	119	206	703	8	0	93	101
75	6361	5026	64	11451	187	517	0	704	909	400	48	1357	8	0	280	288
76	6694	4057	87	10838	212	368	0	580	392	281	1	674	62	0	485	547
77	7245	48	15	7308	235	0	0	235	1135	0	6	1141	35	0	11	46
78	6190	29	25	6244	323	0	0	323	1226	0	15	1241	30	0	3	33
79	5511	13	2	5526	241	0	0	241	1799	0	0	1799	90	0	1	91
80	6824	26	41	6891	40	0	0	40	2235	0	1	2236	23	0	6	29
81	6149	68	41	6258	37	0	0	37	2656	0	6	2662	20	0	1	21
82	5310	6	4	5320	92	0	0	92	2409	0	2	2411	8	0	3	11
83	5483	32	8	5523	80	0	0	80	2102	0	0	2102	33	0	17	50
84	5719	65	9	5793	7	0	0	7	2284	0	6	2290	8	0	0	8
85	4083	0	37	4120	29	0	0	29	941	0	6	947	4	0	6	10
86	3060	6	24	3090	6	0	0	6	694	0	0	694	58	0	10	68
87	4576	14	33	4623	12	0	0	12	1039	0	2	1041	40	0	2	42
88	3061	17	9	3087	112	0	0	112	988	0	1	989	89	0	0	89
89	3352	4	9	3365	187	0	0	187	1459	0	0	1459	93	0	0	93
90	1854	45	20	1919	78	0	0	78	2930	0	1	2931	20	0	12	32
91	176	75	29	280	44	0	0	44	1371	0	0	1371	1371	0	12	1383
92	448	0	106	554	5	0	0	5	1374	0	0	1374	1880	0	10	1890
93	40	0	70	110	2	0	0	2	1650	0	0	1650	1642	0	6	1648
94	96	0	0	96	3	0	0	3	1036	0	0	1036	1408	0	0	1408

Table 3. Reported Landings in metric tons of 4VW Flatfish by Species. Both Canadian and foreign landings as reported by NAFO for 1961-92, Canadian landings only as reported by DFO Statistics for 1993-99. Regional keys were used to assign unspecified flatfish to species throughout 1961-90. Landings for 1999 are preliminary.

Year	Winter Flounder	Witch Flounder	American Plaice	Yellowtail Flounder	Other Flatfish	Unspecified Flatfish	Total	Percent Unspecified
61	138	5018	1384	2908	.	237	9685	2.45
62	127	5777	1485	3479	.	757	11625	6.51
63	82	7411	2059	3888	.	.	13440	-
64	31	8372	2570	5249	.	194	16416	1.18
65	211	12522	7504	5880	.	90	26207	0.34
66	89	14288	13480	4685	.	30	32572	0.09
67	42	7433	9664	4971	.	.	22110	-
68	38	20947	18319	12923	.	17	52244	0.03
69	16	13301	12865	3625	.	2	29809	0.01
70	52	5241	7723	3356	.	9	16381	0.05
71	1601	16723	13756	1557	.	.	33637	-
72	629	10653	10087	1321	.	43	22733	0.19
73	1135	13434	12093	1374	.	176	28212	0.62
74	1782	6917	16314	703	.	101	25817	0.39
75	704	8591	11451	1357	.	288	22391	1.29
76	580	5401	10838	674	.	547	18040	3.03
77	235	2010	7308	1141	.	46	10740	0.43
78	323	2103	6244	1241	.	33	9944	0.33
79	241	1781	5526	1799	.	91	9438	0.96
80	40	1990	6891	2236	.	29	11186	0.26
81	37	1279	6258	2662	.	21	10257	0.20
82	92	890	5320	2411	.	11	8724	0.13
83	80	1004	5523	2102	.	50	8759	0.57
84	7	1340	5793	2290	3	8	9441	0.08
85	29	1746	4120	947	.	10	6852	0.15
86	6	2383	3090	694	.	68	6241	1.09
87	12	2725	4623	1041	.	42	8443	0.50
88	112	2406	3087	989	.	89	6683	1.33
89	187	1765	3365	1459	.	93	6869	1.35
90	78	1304	1919	2931	.	32	6264	0.51
91	44	1336	280	1371	.	1383	4414	31.33
92	5	1032	554	1374	.	1890	4855	38.93
93	2	532	123	1648	.	1656	3961	41.80
94	3	276	106	1035	.	1408	2827	49.80
95	0	317	370	736	.	921	2344	39.28
96	4	390	647	390	.	543	1974	27.51
97	2	364	948	77	.	678	2069	32.76
98	2	451	1128	32	.	348	1961	17.73
99	0	231	1154	47	.	398	1830	21.74

TABLE 4. Quota management summary (metric tons) for 4VW flounder, as of March 24, 2000.

Fleet	Allocation	Reported Catch	% Taken	Comments
1994				
4VWX,5Y Mobile < 65' ITQ (Jan 1-Mar 31)	0	704	-	
Fixed < 65'	363	9	2%	
Mobile < 65' - Gulf based vessels (Jan -	158	61	39%	
Mobile < 65' - Quebec based vessels (Jan-	2	0	0%	
Mobile < 65' - Nfld based vessels (Jan-D	2	0	0%	
Mobile < 65' ITQ (Apr 1 - Dec 31)	2,088	2,261	108%	
Mobile 65' - 100'	79	18	23%	
Vessels > 100'	2,809	429	15%	
Total	5,501	3,482	63%	
1995				
Fixed < 65'	272	5	2%	
Mobile < 65' (S-F - ITQ)	1,566	1,447	92%	
Mobile < 65' based in 4T,3Pn (bycatch)	121	106	88%	Closed 95/10/2
Mobile 65' - 100'	152	152	100%	
Vessels > 100'	2,014	582	29%	
Total	4,125	2,292	56%	
1996				
Fixed < 65'	230	6	3%	
Mobile < 65' (S-F - ITQ)	1,329	1,264	95%	
Mobile < 65' based in 4T,3Pn (bycatch)	103	67	65%	
Mobile 65' - 100'	50	43	86%	
Vessels > 100'	1,788	602	34%	
Total	3,500	1,982	57%	
1997				
Fixed < 65'	197	3	2%	
Mobile < 65' (S-F - ITQ)	1,139	1,049	92%	
Mobile < 65' based in 4T,3Pn (bycatch)	88	100	114%	Closed 97/05/2
Mobile 65' - 100'	43	10	23%	
Vessels > 100'	1,533	856	56%	
Total	3,000	2,018	67%	
1998				
Fixed < 65'	197	9	5%	
Mobile < 65' (S-F - ITQ)	1,139	1,048	92%	
Mobile < 65' based in 4T,3Pn (bycatch)	88	85	97%	
Mobile 65' - 100'	43	25	58%	
Vessels > 100'	1,533	732	48%	
Total	3,000	1,899	63%	
1999				
Fixed < 65'	203	3	1%	
Mobile < 65' (S-F - ITQ)	1,146	820	72%	
Mobile < 65' based in 4T,3Pn (bycatch)	89	149	167%	Closed 99/05/0
Mobile 65' - 100'	44	49	111%	
Vessels > 100'	1,548	816	53%	
Total	3,030	1,837	61%	

TABLE 5. 4VW FLATFISH LANDINGS ADJUSTED BY REPLACING UNSPECIFIED FLOUNDER IN THE COMMERCIAL LANDINGS WITH PROPORTIONS OF NAMED OR UNSPECIFIED FLOUNDER IN THE FISHING LOG DATABASE.

		PLAICE	YELLOWTAIL	WINTER	WITCH	UNSPEC. FLATFISH	TOTAL	PERCENT UNSPECIFIED
Commercial	1992	53	1372	4	912	1883	4225	44.6%
	1993	84	1625	2	520	1656	3886	42.6%
	1994	66	1035	3	260	1408	2771	50.8%
	1995	328	736	0	299	921	2284	40.3%
	1996	596	390	4	326	543	1858	29.2%
	1997	895	77	2	298	677	1949	34.7%
	1998	1026	32	2	407	348	1815	19.2%
	1999	1073	47	0	163	398	1681	23.7%
Adjusted	1992	479	1390	7	922	1425	4223	33.8%
	1993	778	1864	3	527	714	3886	18.4%
	1994	836	1219	3	284	430	2771	15.5%
	1995	843	921	0	303	216	2284	9.5%
	1996	953	396	4	332	173	1858	9.3%
	1997	1206	87	2	306	349	1950	17.9%
	1998	1258	33	2	412	110	1814	6.1%
	1999	1269	47	0	167	198	1681	11.8%

Table 6. Canadian Commercial Landings in metric tons as reported by DFO Statistics for 1968-99 by major fisheries, gear types and tonnage classes. Landings for 1992-99 are adjusted for species identification in the fishing logs, and do not include landings outside Scotia/Fundy.

	Otter Trawl, Tonnage Classes 1-3			Otter Trawl, Tonnage Class 4			Otter Trawl, Tonnage Classes 5+		
Year	American Plaice	Yellowtail Flounder	Unidentified Flatfish	American Plaice	Yellowtail Flounder	Unidentified Flatfish	American Plaice	Yellowtail Flounder	Unidentified Flatfish
68	160	43	3	4989	3127	197	1536	1851	226
69	182	.	57	4659	874	70	2919	1498	21
70	57	0	36	3723	348	33	1181	368	.
71	181	.	117	3906	506	9	1789	273	.
72	133	3	.	3006	701	32	1348	129	.
73	127	.	1	1896	254	.	649	24	.
74	209	0	.	1988	144	.	1778	190	8
75	140	1	.	2580	470	6	1392	29	.
76	239	.	.	2152	80	0	1938	285	61
77	249	26	14	2436	619	8	1965	333	.
78	258	5	11	1513	561	.	1992	454	8
79	174	20	14	1984	1194	7	1762	366	.
80	241	71	.	2309	1318	5	1807	364	9
81	184	95	3	2643	1841	.	1231	444	.
82	552	205	3	2251	1960	1	512	119	3
83	430	70	2	1844	1616	24	971	124	.
84	406	157	3	1941	1490	.	1166	181	.
85	183	49	1	609	137	.	1660	402	1
86	402	106	43	309	62	1	665	166	2
87	457	61	29	436	62	.	1473	336	.
88	515	82	44	296	64	.	436	158	1
89	1036	880	81	325	57	.	203	110	0
90	540	2150	13	148	13	1	271	189	0
91	19	542	163	.	8	93	42	242	540
92	14	216	112	0	0	50	44	279	893
93	84	446	145	0	16	25	98	6	157
94	180	310	101	36	49	92	25	0	2
95	254	211	75	34	117	0	22	1	5
96	375	93	36	.	.	.	98	0	0
97	300	15	68	10	0	0	19	0	3
98	358	2	27	.	.	.	2	0	0
99	442	31	151	0	0	0	1	0	0

Table 6 (con't). Canadian Commercial Landings in metric tons as reported by DFO Statistics for 1968-99 by major fisheries, gear types and tonnage classes. Landings for 1992-99 are adjusted for species identification in the fishing logs, and do not include landings outside Scotia/Fundy.

	Danish Seine			Longline			Miscellaneous Gears		
Year	American Plaice	Yellowtail Flounder	Unidentified Flatfish	American Plaice	Yellowtail Flounder	Unidentified Flatfish	American Plaice	Yellowtail Flounder	Unidentified Flatfish
68	413	0	.	84	.	.	195	1	.
69	395	2	.	130	1	.	104	7	.
70	432	1	.	222	3	0	34	13	.
71	566	9	.	398	5	.	115	29	.
72	388	1	.	447	3	.	63	11	.
73	514	11	.	395	4	.	114	10	.
74	560	16	.	330	2	0	272	2	.
75	743	13	2	345	1	0	355	40	.
76	1265	21	1	219	1	0	158	3	1
77	1556	118	10	325	1	0	181	1	3
78	1262	83	11	343	4	0	348	81	.
79	872	103	16	370	6	48	169	14	4
80	1363	182	8	445	7	.	293	99	.
81	779	19	.	718	9	17	218	136	.
82	499	11	1	977	5	0	110	40	0
83	751	16	4	931	11	3	381	148	.
84	880	81	3	706	29	1	460	218	0
85	603	176	.	732	79	1	152	43	1
86	627	73	.	791	136	1	163	48	11
87	482	68	.	1006	220	8	213	247	3
88	483	107	5	754	273	4	325	224	35
89	570	102	1	689	48	4	336	212	6
90	316	375	0	299	39	2	78	153	4
91	29	399	353	1	40	124	13	138	142
92	350	724	169	0	29	132	70	143	69
93	523	1198	186	0	12	56	72	185	144
94	593	854	232	0	4	2	2	1	1
95	527	589	129	1	0	1	4	2	6
96	435	302	133	2	0	3	43	0	1
97	863	72	271	4	0	3	9	0	3
98	893	30	80	5	0	0	0	0	3
99	827	16	42	0	0	2	0	0	1

Table 7. Seasonal and geographic summary of Canadian Commercial Landings of American plaice, yellowtail flounder, and unidentified flatfish since 1992, adjusted for Fishing Log species identification. Landings outside Scotia/Fundy are not included.

American Plaice

	1992			1993			1994			1995			1996			1997			1998			1999		
	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W
Jan	0	0	0	0	0	0	.	1	0	.	0	0	.	0	0	.	0	0	.	0	0	.	3	0
Feb	0	0	0	0	0	0	0	1	0	.	0	0	.	14	1	.	0	0	0	11	0	.	36	0
Mar	0	0	0	0	3	0	.	18	0	.	17	0	.	4	0	.	0	0	.	50	0	.	29	0
Apr	0	3	0	1	3	0	0	20	0	.	5	0	0	11	0	.	1	0	0	14	0	.	1	0
May	78	7	2	64	70	0	83	42	0	26	43	1	72	23	0	152	17	0	159	47	0	178	84	0
Jun	96	65	17	84	127	8	98	174	1	108	110	1	89	137	1	90	101	0	68	112	0	93	186	0
Jul	57	5	0	70	120	1	51	190	9	58	183	11	38	209	4	75	170	1	47	146	1	81	106	0
Aug	20	9	30	35	32	71	18	88	0	23	107	0	44	182	27	80	169	0	57	158	0	81	143	0
Sep	40	3	0	33	0	6	0	11	0	47	14	0	33	7	0	52	116	19	111	99	0	95	52	0
Oct	16	17	0	20	9	1	0	17	0	47	17	0	22	15	0	120	13	0	63	13	0	31	42	0
Nov	11	1	0	19	0	0	1	11	0	18	5	0	18	0	0	16	2	0	72	28	0	27	0	0
Dec	0	0	0	0	0	0	0	1	0	0	1	.	0	0	2	.	11	0	2	0	0	.	.	0
Total	319	110	50	325	366	87	251	574	11	327	502	14	317	601	35	586	599	21	579	678	1	587	682	1

Yellowtail Flounder

	1992			1993			1994			1995			1996			1997			1998			1999		
	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W
Jan	1	0	0	0	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0
Feb	0	0	0	0	0	0	0	0	0	.	0	0	.	0	0	.	0	0	0	0	0	.	0	0
Mar	0	1	1	0	4	0	.	0	0	.	0	0	.	0	0	.	0	0	.	1	0	.	0	0
Apr	0	18	6	0	30	0	0	20	0	.	5	0	0	7	0	.	0	0	0	1	0	.	0	0
May	3	8	5	0	45	0	0	149	0	0	4	0	0	40	0	0	1	0	0	26	0	0	43	0
Jun	5	129	3	0	160	0	0	174	0	17	21	1	0	20	1	0	0	0	0	0	0	0	0	0
Jul	1	247	3	1	393	2	0	341	0	1	291	2	0	46	0	0	20	0	0	4	0	0	0	0
Aug	1	539	3	5	354	1	0	279	0	1	257	0	0	185	0	0	57	0	0	0	0	0	0	0
Sep	2	329	1	1	706	0	0	152	3	0	108	0	0	70	0	0	8	0	1	0	0	0	0	0
Oct	1	63	1	0	150	0	1	95	0	0	208	0	0	25	0	0	0	0	0	0	0	0	0	1
Nov	3	18	0	0	6	1	0	3	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	3
Dec	0	0	0	0	0	1	0	0	0	0	0	.	0	0	0	.	0	0	0	0	0	.	.	0
Total	17	1351	23	9	1850	6	1	1213	5	19	898	5	0	394	2	0	87	1	1	32	0	0	43	4

Unidentified Flatfish

	1992			1993			1994			1995			1996			1997			1998			1999		
	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W
Jan	2	40	3	1	2	0	.	0	0	.	0	0	.	0	0	.	1	0	.	0	0	.	19	0
Feb	40	20	1	4	2	0	0	0	0	.	0	0	.	7	0	.	0	0	0	0	0	.	17	0
Mar	17	65	0	0	12	0	.	0	0	.	0	0	.	0	0	.	0	0	.	1	0	.	5	0
Apr	7	49	5	11	50	3	0	32	1	.	1	0	0	0	0	.	0	0	0	2	0	.	0	0
May	42	51	10	11	67	1	7	28	0	0	29	0	25	21	0	34	16	0	4	31	1	2	53	0
Jun	25	167	13	6	235	2	12	109	0	26	49	5	11	43	0	4	75	2	5	4	1	0	16	0
Jul	11	89	8	17	94	9	14	97	2	5	59	4	0	13	0	1	102	0	11	42	0	4	44	0
Aug	15	125	10	19	57	8	2	87	0	1	18	0	16	8	0	2	83	0	7	0	0	1	10	0
Sep	22	138	6	11	17	5	0	27	0	5	3	0	10	0	0	1	10	4	0	0	0	0	22	0
Oct	24	78	8	6	50	3	1	8	1	7	0	0	2	14	0	7	0	0	0	0	0	1	1	0
Nov	15	183	3	8	1	0	0	0	1	4	0	0	1	0	0	4	0	0	0	0	0	1	0	0
Dec	2	128	1	0	1	0	0	0	0	0	0	.	0	0	2	.	1	0	0	0	0	.	.	0
Total	222	1135	68	95	588	30	36	389	5	48	159	10	65	106	2	55	288	7	28	80	2	8	188	2

Table 7. Seasonal and geographic summary of Canadian Commercial Landings of American plaice, yellowtail flounder, and unidentified flatfish since 1992, adjusted for Fishing Log species identification. Landings outside Scotia/Fundy are not included.

American Plaice

	1992			1993			1994			1995			1996			1997			1998			1999		
	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W
Jan	0	0	0	0	0	0	.	1	0	.	0	0	.	0	0	.	0	0	.	0	0	.	3	0
Feb	0	0	0	0	0	0	0	1	0	.	0	0	.	14	1	.	0	0	0	11	0	.	36	0
Mar	0	0	0	0	3	0	.	18	0	.	17	0	.	4	0	.	0	0	.	50	0	.	29	0
Apr	0	3	0	1	3	0	0	20	0	.	5	0	0	11	0	.	1	0	0	14	0	.	1	0
May	78	7	2	64	70	0	83	42	0	26	43	1	72	23	0	152	17	0	159	47	0	178	84	0
Jun	96	65	17	84	127	8	98	174	1	108	110	1	89	137	1	90	101	0	68	112	0	93	186	0
Jul	57	5	0	70	120	1	51	190	9	58	183	11	38	209	4	75	170	1	47	146	1	81	106	0
Aug	20	9	30	35	32	71	18	88	0	23	107	0	44	182	27	80	169	0	57	158	0	81	143	0
Sep	40	3	0	33	0	6	0	11	0	47	14	0	33	7	0	52	116	19	111	99	0	95	52	0
Oct	16	17	0	20	9	1	0	17	0	47	17	0	22	15	0	120	13	0	63	13	0	31	42	0
Nov	11	1	0	19	0	0	1	11	0	18	5	0	18	0	0	16	2	0	72	28	0	27	0	0
Dec	0	0	0	0	0	0	0	1	0	0	1	.	0	0	2	.	11	0	2	0	0	.	.	0
Total	319	110	50	325	366	87	251	574	11	327	502	14	317	601	35	586	599	21	579	678	1	587	682	1

Yellowtail Flounder

	1992			1993			1994			1995			1996			1997			1998			1999		
	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W
Jan	1	0	0	0	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0	.	0	0
Feb	0	0	0	0	0	0	0	0	0	.	0	0	.	0	0	.	0	0	0	0	0	.	0	0
Mar	0	1	1	0	4	0	.	0	0	.	0	0	.	0	0	.	0	0	.	1	0	.	0	0
Apr	0	18	6	0	30	0	0	20	0	.	5	0	0	7	0	.	0	0	0	1	0	.	0	0
May	3	8	5	0	45	0	0	149	0	0	4	0	0	40	0	0	1	0	0	26	0	0	43	0
Jun	5	129	3	0	160	0	0	174	0	17	21	1	0	20	1	0	0	0	0	0	0	0	0	0
Jul	1	247	3	1	393	2	0	341	0	1	291	2	0	46	0	0	20	0	0	4	0	0	0	0
Aug	1	539	3	5	354	1	0	279	0	1	257	0	0	185	0	0	57	0	0	0	0	0	0	0
Sep	2	329	1	1	706	0	0	152	3	0	108	0	0	70	0	0	8	0	1	0	0	0	0	0
Oct	1	63	1	0	150	0	1	95	0	0	208	0	0	25	0	0	0	0	0	0	0	0	0	1
Nov	3	18	0	0	6	1	0	3	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	3
Dec	0	0	0	0	0	1	0	0	0	0	0	.	0	0	0	.	0	0	0	0	0	.	.	0
Total	17	1351	23	9	1850	6	1	1213	5	19	898	5	0	394	2	0	87	1	1	32	0	0	43	4

Unidentified Flatfish

	1992			1993			1994			1995			1996			1997			1998			1999		
	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W	4VN	4VS	4W
Jan	2	40	3	1	2	0	.	0	0	.	0	0	.	0	0	.	1	0	.	0	0	.	19	0
Feb	40	20	1	4	2	0	0	0	0	.	0	0	.	7	0	.	0	0	0	0	0	.	17	0
Mar	17	65	0	0	12	0	.	0	0	.	0	0	.	0	0	.	0	0	.	1	0	.	5	0
Apr	7	49	5	11	50	3	0	32	1	.	1	0	0	0	0	.	0	0	0	2	0	.	0	0
May	42	51	10	11	67	1	7	28	0	0	29	0	25	21	0	34	16	0	4	31	1	2	53	0
Jun	25	167	13	6	235	2	12	109	0	26	49	5	11	43	0	4	75	2	5	4	1	0	16	0
Jul	11	89	8	17	94	9	14	97	2	5	59	4	0	13	0	1	102	0	11	42	0	4	44	0
Aug	15	125	10	19	57	8	2	87	0	1	18	0	16	8	0	2	83	0	7	0	0	1	10	0
Sep	22	138	6	11	17	5	0	27	0	5	3	0	10	0	0	1	10	4	0	0	0	0	22	0
Oct	24	78	8	6	50	3	1	8	1	7	0	0	2	14	0	7	0	0	0	0	0	1	1	0
Nov	15	183	3	8	1	0	0	0	1	4	0	0	1	0	0	4	0	0	0	0	0	1	0	0
Dec	2	128	1	0	1	0	0	0	0	0	0	.	0	0	2	.	1	0	0	0	0	.	.	0
Total	222	1135	68	95	588	30	36	389	5	48	159	10	65	106	2	55	288	7	28	80	2	8	188	2

Table 9. Summary of the directed fishing for American plaice and yellowtail flounder used in catch rate analyses.

Catch Series	**American Plaice**	1992	1993	1994	1995	1996	1997	1998	1999
4Vn Danish Seine	Landings in tons	282	314	242	310	277	570	560	548
	Directed catch series in tons	144	206	186	248	228	502	486	499
	Catch series as % of landings	51%	66%	77%	80%	82%	88%	87%	91%
	Number of sets in catch series	546	918	635	636	577	922	1177	1093
	Number of boats in catch series	13	17	14	18	13	11	15	11
4Vs Danish Seine	Landings in tons	65	209	349	216	156	290	333	278
	Directed catch series in tons	44	172	310	196	146	248	326	266
	Catch series as % of landings	68%	82%	89%	91%	93%	85%	98%	96%
	Number of sets in catch series	53	185	350	306	257	396	435	258
	Number of boats in catch series	6	6	10	9	6	8	9	7
4Vs Otter Trawl (TC 1-3)	Landings in tons	11	83	173	241	359	298	343	403
	Directed catch series in tons	3	31	144	221	339	50	94	133
	Catch series as % of landings	27%	38%	83%	92%	94%	17%	28%	33%
	Number of sets in catch series	16	24	207	206	292	89	162	215
	Number of boats in catch series	1	2	4	6	8	4	6	7

	Yellowtail Flounder	1992	1993	1994	1995	1996	1997	1998	1999
4Vs Danish Seine	Landings in tons	705	1195	854	571	301	71	29	12
	Directed catch series in tons	534	1107	735	512	284	62	13	7
	Catch series as % of landings	76%	93%	86%	90%	94%	87%	44%	60%
	Number of sets in catch series	520	795	857	450	323	71	14	6
	Number of boats in catch series	11	13	19	9	6	6	2	1
4Vs Otter Trawl (TC 1-3)	Landings in tons	213	446	309	211	93	15	2	31
	Directed catch series in tons	149	251	245	174	89	9	.	.
	Catch series as % of landings	70%	56%	79%	83%	95%	59%	.	.
	Number of sets in catch series	178	177	257	137	87	18	.	.
	Number of boats in catch series	4	4	8	7	4	2	.	.

Table 10. Mean numbers per tow (not stratified) of Research Vessel survey catches of 4VW American plaice by year and strata.

Stratum	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
440	3.00	4.50	15.50	0.00	5.67	1.00	2.00	0.00	9.67	2.33	2.33	0.33	3.33	2.33	2.00	2.00	5.60
441	116.00	21.50	235.00	60.67	53.00	20.00	197.00	236.67	20.67	116.00	51.00	81.33	62.67	57.00	95.00	13.60	143.40
442	9.67	32.00	10.00	22.00	70.33	66.00	4.00	2.33	29.00	34.00	156.67	37.33	27.67	60.67	160.67	22.67	10.80
443	120.50	96.50	70.00	68.00	285.88	95.33	93.00	16.00	21.00	178.50	63.00	46.67	86.60	26.75	80.00	31.75	23.67
444	70.67	152.00	143.40	62.00	142.33	107.75	122.50	81.00	27.00	190.75	211.50	95.80	161.40	147.17	101.00	69.00	42.67
445	48.60	38.50	15.80	7.50	26.60	35.40	14.00	26.33	8.50	7.00	31.50	7.25	63.20	11.33	24.00	33.20	90.00
446	11.50	5.50	1.00	0.00	2.00	0.00	2.67	10.67	1.00	4.00	3.33	6.67	8.00	3.67	6.33	3.25	1.00
447	112.50	81.00	31.00	41.40	61.00	29.75	89.25	42.67	44.50	82.50	128.60	207.50	74.50	149.00	80.50	74.25	32.60
448	134.60	43.50	40.00	33.75	91.20	65.00	119.50	45.50	38.50	41.50	103.50	82.25	99.75	116.50	200.25	314.25	86.80
449	346.00	31.50	0.50	132.00	163.67	110.00	62.00	23.00	35.00	13.00	32.50	12.00	6.00	3.50	13.00	4.50	5.50
450	23.00	73.00	19.33	42.50	108.67	73.00	90.67	25.00	85.33	23.33	4.33	26.67	9.00	49.67	20.33	60.00	11.00
451	5.00	8.50	3.50	10.50	12.00	4.00	12.50	8.00	2.50	1.00	1.00	0.00	7.33	11.50	6.00	31.50	1.50
452	0.50	9.00	6.00	6.50	23.50	12.00	28.50	13.00	12.00	5.50	9.00	8.00	9.00	15.00	46.50	7.00	11.50
453	10.50	16.00	3.00	25.67	1.67	2.67	14.33	24.67	14.00	10.67	8.00	5.33	6.67	34.00	17.33	21.00	7.33
454	33.33	7.50	37.00	25.33	13.67	40.67	12.33	13.33	7.00	6.67	7.67	21.50	30.33	3.33	15.00	1.33	4.67
455	19.57	38.83	50.86	9.50	42.86	7.33	24.00	18.00	18.86	42.86	16.00	17.00	11.00	36.14	10.14	15.29	4.75
456	90.00	4.75	4.00	7.60	30.60	43.83	9.00	12.33	113.00	155.83	3.50	31.50	35.83	11.67	6.67	12.17	9.17
457	52.00	23.50	46.50	20.50	7.33	31.00	4.00	20.50	76.50	2.50	2.50	14.00	5.50	4.00	6.00	4.50	71.00
458	54.00	40.00	7.33	8.00	46.67	71.00	24.67	4.00	9.00	17.67	22.33	27.00	23.67	8.00	25.67	32.33	3.20
459	50.67	55.00	31.25	153.00	151.00	163.00	107.25	61.25	91.25	50.75	28.50	63.75	18.67	60.00	26.00	43.33	83.67
460	1.50	8.50	1.50	4.00	18.00	6.50	4.00	4.50	6.00	19.50	0.00	6.50	65.50	6.50	94.00	6.00	13.75
461	4.33	4.00	3.50	8.00	5.50	2.00	2.50	0.00	3.00	0.00	0.50	0.00	0.00	1.00	0.50	0.50	2.00
462	39.67	17.00	21.00	11.67	14.75	26.00	2.75	8.25	73.75	16.25	12.83	8.00	12.00	20.00	11.25	29.00	14.83
463	5.50	28.00	22.50	14.50	2.50	0.00	2.00	1.00	33.00	0.00	0.00	0.00	20.00	2.00	12.00	0.00	0.50
464	41.75	14.00	5.20	6.33	41.33	10.83	4.40	3.60	3.80	1.80	1.00	12.80	7.25	0.80	3.00	4.80	7.00
465	8.50	6.40	2.80	9.00	5.00	0.25	0.80	2.20	7.20	25.40	1.20	4.14	3.50	1.00	1.20	0.00	3.60
466	1.00	3.50	2.33	7.00	13.33	4.00	9.00	4.67	6.33	9.33	1.00	1.00	6.67	7.00	12.67	14.67	4.67

Stratum	87	88	89	90	91	92	93	94	95	96	97	98	99	00
440	2.00	1.17	0.50	3.75	2.75	1.00	0.00	0.75	1.00	0.25	1.50	0.50	0.75	7.67
441	29.75	32.00	48.00	99.17	83.60	12.20	62.20	146.40	27.00	164.80	127.80	124.40	36.17	72.43
442	63.83	38.57	23.60	36.60	34.00	24.33	32.80	55.67	105.50	35.33	37.50	132.33	71.14	12.50
443	77.33	5.75	77.00	15.00	27.00	39.50	19.00	32.33	68.25	50.75	45.22	22.60	44.75	5.00
444	65.33	26.75	39.00	139.14	129.75	68.50	49.89	64.17	140.88	90.88	106.50	94.13	112.38	98.44
445	32.00	39.75	126.75	13.00	18.75	20.50	61.80	18.57	97.75	26.75	1.00	67.67	127.33	43.83
446	2.67	1.00	2.67	62.67	20.33	20.33	0.00	0.67	1.00	10.33	3.00	4.67	85.33	11.67
447	49.00	69.00	63.00	42.00	68.00	63.43	58.00	26.00	74.86	25.00	27.43	37.14	29.67	87.43
448	37.80	49.00	207.80	19.11	41.17	35.00	16.29	2.29	8.57	4.67	23.29	5.33	15.00	91.63
449	19.00	7.00	14.50	17.50	23.50	193.50	11.00	46.00	34.00	3.00	16.00	30.00	6.50	22.50
450	8.33	15.00	22.33	58.33	159.67	51.33	141.33	61.33	28.33	20.33	22.33	0.00	6.00	11.00
451	5.00	0.00	1.00	10.00	17.00	5.00	0.50	8.50	8.00	269.50	36.50	279.50	27.50	27.50
452	5.00	37.50	25.50	21.33	38.50	7.00	14.50	1.50	20.50	42.50	14.50	71.50	17.50	25.33
453	6.50	3.00	3.00	1.00	25.00	3.00	10.00	2.50	3.00	1.00	21.00	88.50	11.00	9.00
454	49.00	20.50	14.50	8.33	23.50	21.50	5.50	2.00	9.50	22.33	14.00	4.00	25.50	17.00
455	17.13	6.57	11.86	58.75	15.10	26.70	9.33	4.90	7.40	9.30	4.08	15.88	17.18	2.27
456	13.29	3.00	20.67	18.50	9.43	3.29	7.88	4.75	4.75	8.50	8.13	14.00	17.25	12.80
457	31.50	5.50	4.50	3.75	84.50	11.50	7.00	9.50	14.50	7.50	5.50	4.50	6.00	4.50
458	10.00	12.33	18.00	9.11	14.63	25.25	27.50	45.38	27.38	16.43	26.38	47.00	34.67	45.20
459	62.40	79.00	17.80	45.00	104.80	37.00	52.50	29.67	46.83	55.00	25.40	74.00	21.33	43.63
460	7.33	50.00	16.67	6.00	3.33	6.00	7.33	16.67	7.67	17.00	11.00	13.33	24.00	11.67
461	0.33	2.50	3.00	0.00	2.00	0.50	3.50	3.00	2.50	1.00	0.50	7.50	7.50	8.00
462	9.40	15.50	12.00	29.80	16.80	16.00	20.75	16.50	28.00	24.50	7.25	27.75	31.50	23.50
463	0.00	1.50	1.50	22.00	2.00	0.00	2.50	5.50	4.50	14.00	4.00	11.00	9.50	23.00
464	4.67	7.60	34.20	33.44	61.14	29.29	20.29	19.00	7.43	8.43	17.25	21.14	15.57	11.43
465	1.50	8.00	8.63	6.42	1.11	2.10	3.10	2.20	9.00	3.60	4.10	5.89	5.60	2.20
466	1.50	7.50	9.00	1.00	0.00	2.00	5.50	5.00	2.00	0.00	3.50	2.67	2.50	11.00

Table 11(a). Stratified mean weights and numbers per tow, trawlable abundance and biomass estimates, and associated bootstrapped standard errors, 95% confidence intervals and survey design efficiency estimates for 1970-2000 4VW American plaice. The total, pre-recruit, and fishery-sized numbers per tow are independent estimates. Differences between total and sums of pre-recruit + fishery-sized numbers can result from discrepancies between fish counts and length frequency tallies.

Year	Mean Number per Tow	Mean Pre-recruits per Tow	Mean Fishery-sized per Tow	Mean Weight per Tow (kg)	Standard Error	Lower Confidence Interval	Upper Confidence Interval	Abundance Estimate	Biomass Estimate (metric tons)	Biomass Standard Error	Bootstrap Lower Confidence Interval	Bootstrap Upper Confidence Interval	Set Allocation per Strata Efficiency	Stratification versus Random Efficiency	Overall Efficiency
70	50.14	34.45	15.10	12.64	1.62	9.97	16.15	133116394	33548	4410	26474	42886	-19.6	41.7	22.1
71	47.52	31.46	17.16	15.30	3.76	8.45	22.56	126747605	40820	10065	22526	60168	-84.4	13.1	-71.3
72	42.30	27.76	12.78	11.71	1.76	8.56	15.14	112823131	31246	4791	22834	40395	-28.2	33.9	5.7
73	36.41	19.81	15.40	10.22	2.19	6.54	15.19	97130006	27264	5908	17451	40513	-45.5	27.0	-18.5
74	71.33	40.56	30.93	19.84	4.43	13.73	32.53	182134014	50648	11330	35059	83064	26.1	7.2	33.3
75	53.02	27.46	27.57	17.32	3.32	11.39	24.06	141431103	46209	8648	30392	64186	-57.5	33.3	-24.2
76	58.98	44.99	40.83	20.89	6.63	11.75	39.29	140626816	49811	15967	28008	93685	-57.9	8.8	-49.1
77	34.72	20.90	15.46	9.94	1.99	6.31	13.78	92608582	26519	5458	16826	36747	-58.3	26.3	-32.1
78	38.19	28.66	17.35	11.21	2.55	6.90	16.97	101391022	29773	6940	18313	45056	7.2	2.3	9.4
79	57.58	30.04	26.01	19.33	3.11	14.46	26.63	153576904	51547	8435	38562	71035	22.7	22.2	44.9
80	57.44	24.50	35.24	21.37	8.07	9.33	41.27	153222289	57010	21639	24875	110070	-110.4	7.1	-103.2
81	50.66	29.38	29.25	19.06	4.20	11.85	28.85	135115975	50834	11314	31620	76940	-68.6	16.7	-52.0
82	48.79	28.60	21.89	14.82	2.25	10.79	19.67	129538476	39347	5995	28645	52234	-29.0	43.5	14.5
83	48.82	28.17	19.89	12.97	2.92	8.40	20.22	130225810	34602	7798	22404	53936	-47.5	11.7	-35.8
84	52.21	32.62	21.25	13.68	3.06	8.51	20.74	139262706	36481	8447	22708	55320	-24.1	6.2	-17.9
85	41.33	22.10	19.90	14.46	4.46	8.31	26.60	110244056	38573	12124	22156	70964	-12.7	12.8	0.1
86	36.26	27.66	11.77	8.37	1.40	5.92	11.40	96715771	22336	3606	15787	30405	-27.3	19.4	-7.9
87	32.81	20.09	13.79	9.30	1.53	6.69	12.69	87514131	24805	4068	17841	33842	-12.3	15.2	2.9
88	28.30	18.11	11.14	7.18	1.03	5.45	9.42	75485605	19138	2770	14524	25127	-3.5	22.0	18.5
89	37.70	18.18	21.42	11.48	4.12	5.92	23.86	100565494	30621	11184	15777	63635	6.6	1.7	8.3
90	43.58	27.93	15.47	10.05	2.32	6.79	17.13	111969206	25825	5855	17453	44005	-53.0	13.1	-39.9
91	51.11	39.57	13.78	10.17	1.26	7.92	12.83	136314462	27121	3334	21115	34218	-26.7	32.3	5.7
92	29.77	20.29	11.22	7.07	0.93	5.56	9.32	79400497	18867	2438	14828	24855	-2.7	47.5	44.8
93	27.77	20.66	6.59	5.28	0.77	4.02	7.12	74084381	14075	2040	10734	18979	-8.3	22.8	14.5
94	28.12	24.18	5.05	4.16	0.53	3.23	5.35	74996833	11103	1475	8608	14263	-0.8	21.0	20.2
95	43.82	34.43	9.21	6.91	0.95	5.19	8.94	116878980	18427	2655	13848	23846	-19.6	38.2	18.5
96	35.00	26.01	8.85	5.82	0.78	4.38	7.47	93358022	15517	2139	11676	19923	32.5	22.9	55.4
97	31.12	21.12	9.79	6.21	1.16	4.38	8.97	79925473	15954	2978	11255	23046	-51.3	51.3	0.0
98	44.99	34.91	11.00	7.31	1.39	4.99	10.61	120000000	19504	3702	13313	28295	-12.6	22.2	9.7
99	38.76	27.43	10.25	6.70	1.30	4.64	9.76	100715280	17423	3458	12069	25371	-13.1	15.9	2.8
00	36.51	31.85	5.42	5.84	1.04	4.25	8.37	97388317	15573	2771	11331	22331	-38.3	24.6	-13.7

Table 11(b). Stratified mean weights and numbers per tow, trawlable abundance and biomass estimates, and associated bootstrapped standard errors, 95% confidence intervals and survey design efficiency estimates for 1970-2000 4Vs American plaice. The total, pre-recruit, and fishery-sized numbers per tow are independent estimates. Differences between total and sums of pre-recruit + fishery-sized numbers can result from discrepancies between fish counts and length frequency tallies.

Year	Mean Number per Tow	Mean Pre-recruits per Tow	Mean Fishery-sized per Tow	Mean Weight per Tow (kg)	Standard Error	Lower Confidence Interval	Upper Confidence Interval	Abundance Estimate	Biomass Estimate (metric tons)	Biomass Standard Error	Bootstrap Lower Confidence Interval	Bootstrap Upper Confidence Interval	Set Allocation per Strata Efficiency	Stratification versus Random Efficiency	Overall Efficiency
70	86.63	67.40	20.37	25.89	4.51	18.47	36.19	78507837	23466	4019	16738	32793	-27.7	19.4	-8.3
71	96.46	79.45	22.30	30.32	10.28	13.20	47.89	88614245	27854	9218	12122	43994	-94.4	-8.9	-103.4
72	69.17	49.96	16.03	22.09	3.44	15.52	29.08	63548895	20297	3132	14259	26711	-44.8	31.0	-13.7
73	42.45	28.75	12.53	14.17	3.03	7.84	19.71	38998526	13022	2801	7202	18108	-4.4	8.9	4.6
74	112.92	72.35	38.08	36.01	10.55	22.34	65.47	103740591	33086	9874	20528	60144	27.7	1.3	29.0
75	75.52	53.05	28.62	22.89	3.98	14.45	29.76	69380692	21033	3612	13274	27342	-17.5	30.2	12.7
76	141.58	157.72	71.33	50.47	19.59	22.17	107.33	101979756	36355	14419	15969	77310	-74.2	-8.0	-82.2
77	49.26	35.67	17.01	15.28	4.01	7.74	23.63	45258793	14036	3627	7114	21707	-47.7	7.0	-40.6
78	28.79	17.96	11.04	11.48	2.69	7.14	18.21	26101913	10405	2464	6473	16504	-2.2	-7.3	-9.5
79	100.42	64.68	29.08	36.83	6.78	27.05	55.50	92252499	33836	5969	24854	50987	-4.6	33.9	29.4
80	125.20	59.80	70.80	53.50	22.96	20.93	115.93	115015104	49146	21482	19227	106504	-132.7	-8.4	-141.1
81	97.36	77.41	37.05	35.39	8.60	21.33	55.38	89444775	32512	8387	19596	50874	-77.0	7.2	-69.8
82	105.96	74.34	36.53	34.79	6.46	23.30	48.05	96049238	31540	5705	21123	43552	-56.6	12.6	-44.0
83	95.86	67.67	25.90	25.86	6.95	15.20	43.55	88064273	23762	6220	13968	40007	-52.4	-1.3	-53.7
84	91.03	68.14	24.40	26.38	7.92	14.77	46.52	83623388	24233	7175	13572	42741	-19.0	-3.7	-22.8
85	87.26	53.54	33.50	32.94	12.98	14.44	61.37	80167104	30257	12044	13269	56377	-13.1	5.3	-7.8
86	47.13	37.04	13.91	14.90	3.40	10.03	24.62	43296885	13689	3098	9215	22620	-27.3	-4.2	-31.5
87	51.22	36.12	17.14	16.92	3.63	10.71	24.47	47051599	15546	3410	9840	22482	0.3	-2.9	-2.6
88	33.98	22.25	13.30	12.00	2.50	8.25	18.53	31216325	11021	2302	7579	17026	5.4	10.0	15.5
89	79.33	46.27	38.38	27.92	11.88	11.69	60.07	72874718	25652	11144	10736	55189	6.5	-4.4	2.1
90	67.49	47.88	18.99	17.81	5.21	10.54	32.34	62002123	16360	4986	9680	29714	-101.9	13.1	-88.8
91	77.95	62.10	18.14	18.37	3.11	12.46	24.82	71607846	16874	2789	11446	22800	-26.2	4.9	-21.3
92	54.93	41.30	19.14	15.78	2.60	11.72	21.95	50465367	14496	2350	10767	20161	-0.2	34.3	34.1
93	42.01	33.37	8.16	9.72	1.97	6.58	14.96	38594311	8931	1813	6044	13745	-4.4	7.3	2.9
94	37.18	32.70	5.75	6.91	1.06	4.26	8.58	34154826	6352	948	3915	7883	-17.9	19.8	2.0
95	83.34	71.64	11.98	14.20	2.70	9.79	20.49	76562197	13049	2409	8997	18823	-24.8	24.7	-0.1
96	52.05	41.32	10.92	10.25	1.81	7.18	14.02	47818946	9417	1605	6594	12879	50.6	11.6	62.1
97	58.43	39.48	17.93	15.33	3.51	9.55	24.47	47903870	12564	2895	7829	20057	-78.4	37.6	-40.9
98	56.22	43.67	12.68	12.11	3.45	6.33	20.41	51648618	11127	3156	5816	18751	-20.6	17.4	-3.3
99	69.16	53.72	15.02	14.09	3.55	8.52	22.47	63540143	12945	3325	7830	20643	-9.1	2.4	-6.7
00	68.70	58.06	12.12	12.13	2.86	7.92	20.33	63109478	11140	2631	7278	18677	-42.0	9.4	-32.6

Table 11(c). Stratified mean weights and numbers per tow, trawlable abundance and biomass estimates, and associated bootstrapped standard errors, 95% confidence intervals and survey design efficiency estimates for 1970-2000 4Vn American plaice. The total, pre-recruit, and fishery-sized numbers per tow are independent estimates. Differences between total and sums of pre-recruit + fishery-sized numbers can result from discrepancies between fish counts and length frequency tallies.

Year	Mean Number per Tow	Mean Pre-recruits per Tow	Mean Fishery-sized per Tow	Mean Weight per Tow (kg)	Standard Error	Lower Confidence Interval	Upper Confidence Interval	Abundance Estimate	Biomass Estimate (metric tons)	Biomass Standard Error	Bootstrap Lower Confidence Interval	Bootstrap Upper Confidence Interval	Set Allocation per Strata Efficiency	Stratification versus Random Efficiency	Overall Efficiency
70	34.91	28.35	2.67	5.29	2.38	1.65	11.73	9942276	1506	685	471	3340	11.1	14.0	25.1
71	23.14	8.95	16.38	16.12	13.20	1.42	30.82	6589514	4590	3743	404	8777	-29.0	-5.7	-34.7
72	73.93	57.05	12.81	18.63	12.07	6.29	30.96	21055786	5305	3440	1791	8818	10.3	4.3	14.6
73	27.11	21.97	4.87	6.12	3.33	0.99	12.66	7721564	1743	972	282	3607	-28.0	-2.4	-30.5
74	49.76	39.96	13.04	13.59	5.97	14.78	37.13	14172808	3871	928	4211	10576	-8.8	52.5	43.6
75	37.34	17.37	23.36	18.52	14.47	2.94	54.35	10634175	5275	2443	837	15480	-18.7	33.0	14.3
76	3.59	2.84	1.20	1.09	0.81	0.00	1.99	719190	218	161	0	398	-21.5	-24.3	-45.8
77	69.93	59.72	9.09	13.39	8.44	19.44	47.78	19917672	3813	992	5536	13608	2.7	73.3	76.0
78	19.92	6.38	12.71	8.56	10.24	2.57	42.63	5674824	2439	1611	733	12141	-25.5	-11.2	-36.7
79	51.63	42.78	11.76	12.94	4.81	14.75	33.85	14705107	3686	741	4200	9640	-9.2	49.1	39.9
80	85.56	80.70	11.95	17.29	15.47	10.33	66.21	24368478	4924	2502	2943	18858	-24.0	3.1	-20.9
81	53.00	45.29	25.60	28.08	27.10	12.11	127.40	15096251	7999	3999	3448	36286	-13.4	1.5	-11.9
82	30.82	21.63	8.79	12.00	9.58	6.77	44.05	8778269	3417	1306	1928	12545	-2.4	4.3	1.9
83	41.51	25.86	14.06	17.56	21.08	4.14	78.63	11822800	5001	3561	1180	22396	-28.8	-5.5	-34.3
84	101.84	96.08	13.48	18.97	21.70	7.79	88.53	29005212	5404	3386	2220	25215	-24.7	-6.1	-30.8
85	14.11	4.58	9.79	9.86	0.68	8.48	11.10	4018559	2807	187	2414	3162	0.5	93.7	94.2
86	51.11	44.20	9.47	11.45	11.42	24.59	68.03	14556489	3261	773	7003	19376	3.2	43.6	46.8
87	36.69	28.31	8.52	10.53	3.00	5.85	17.71	10450382	3000	863	1666	5045	-6.6	18.7	12.1
88	25.93	17.98	7.75	8.75	2.73	5.04	17.04	7386335	2492	795	1435	4854	-6.9	12.0	5.1
89	24.16	15.52	8.42	7.55	2.39	4.01	14.03	6882336	2150	685	1142	3995	-3.7	19.2	15.5
90	45.87	30.33	15.28	14.94	9.84	2.96	41.36	13063194	4256	2806	842	11780	24.6	1.7	26.3
91	42.12	36.08	8.27	8.36	2.51	4.90	15.49	11996072	2380	711	1394	4411	9.6	36.0	45.6
92	14.83	12.26	3.35	3.53	0.79	2.27	5.49	4222915	1005	223	648	1564	-2.0	39.0	37.0
93	31.12	27.08	2.90	6.10	1.62	3.59	10.13	8862390	1738	484	1024	2885	12.8	25.3	38.1
94	67.91	66.77	2.00	7.41	3.41	1.38	15.59	19341009	2111	964	394	4440	3.5	4.1	7.6
95	52.00	44.98	5.68	8.82	3.18	3.69	16.61	14811265	2512	903	1051	4731	-2.4	12.3	10.0
96	63.29	55.25	7.22	11.09	4.04	3.89	19.08	18026843	3158	1146	1108	5436	7.5	26.0	33.5
97	54.04	49.79	4.03	6.70	2.26	3.34	12.64	15390649	1908	648	951	3599	6.0	25.7	31.6
98	94.84	87.48	8.58	14.17	5.40	6.14	30.03	27011648	4036	1533	1749	8553	6.9	3.1	10.0
99	41.31	35.27	6.13	7.43	2.87	3.13	15.13	11765229	2115	814	891	4310	-1.8	11.1	9.3
00	29.44	25.81	4.79	4.74	1.26	2.50	7.66	8385238	1350	358	712	2181	-2.1	30.1	28.0

Table 12. Mean weights and numbers per tow, trawlable abundance and biomass estimates, and survey diagnostics for spring and fall surveys of American plaice and yellowtail flounder.

AMERICAN PLAICE

	Year	Mean Number per Tow	Mean Weight per Tow (kg)	Standard Error	Lower Confidence Interval	Upper Confidence Interval	Abundance Estimate	Biomass Estimate (metric tons)	Biomass Standard Error	Bootstrap Lower Confidence Interval	Bootstrap Upper Confidence Interval	Set Allocation per Strata Efficiency	Stratification versus Random Efficiency	Overall Efficiency
4VW,SPRING	79	54.10	15.73	5.39	7.76	28.12	114463907	33274	11151	16409	59502	-128.2	21.3	-106.9
	80	14.52	3.91	0.76	2.55	5.65	29915071	8057	1556	5245	11629	-19.1	32.5	13.4
	81	38.92	17.67	5.44	8.76	29.57	102810006	46673	14900	23142	78107	1.7	38.2	39.9
	82	30.53	9.00	3.42	3.73	17.22	47110282	13896	5464	5751	26572	39.7	5.3	45.0
	83	23.67	7.61	1.10	5.73	9.96	56399072	18128	2609	13653	23723	4.6	42.3	46.8
	84	36.16	10.81	3.14	6.55	19.14	83653923	25005	7253	15149	44275	30.8	16.8	47.5
4VW,FALL	78	34.72	17.77	7.67	6.64	34.71	70700242	36191	15864	13513	70689	-122.9	22.7	-100.2
	79	44.19	13.34	1.99	8.32	16.35	117308885	35424	5386	22084	43419	-8.6	62.6	54.0
	80	37.89	10.17	1.56	7.49	13.66	101062546	27134	4082	19980	36444	-43.0	31.2	-11.8
	81	70.49	18.15	8.99	7.57	29.01	167079040	43031	21151	17938	68774	-337.4	13.8	-323.6
	82	46.85	14.61	3.41	9.61	23.38	124383324	38785	9281	25507	62075	-63.8	20.4	-43.3
	83	35.11	7.30	1.10	5.31	9.34	93203182	19368	2867	14102	24808	-28.2	36.2	8.1
	84	53.61	10.77	3.33	5.99	18.06	143000058	28734	9039	15990	48171	-34.1	3.7	-30.4

YELLOWTAIL FLOUNDER

	Year	Mean Number per Tow	Mean Weight per Tow (kg)	Standard Error	Lower Confidence Interval	Upper Confidence Interval	Abundance Estimate	Biomass Estimate (metric tons)	Biomass Standard Error	Bootstrap Lower Confidence Interval	Bootstrap Upper Confidence Interval	Set Allocation per Strata Efficiency	Stratification versus Random Efficiency	Overall Efficiency
4VW,SPRING	79	16.52	4.92	1.01	3.08	7.01	34944163	10405	2060	6520	14825	-5.9	37.9	32.0
	80	14.85	3.89	0.88	2.25	5.55	30580429	8006	1837	4635	11437	-0.9	43.2	42.2
	81	19.41	5.30	1.08	3.35	7.55	51273693	13990	2904	8853	19942	3.3	40.7	44.0
	82	46.92	11.98	5.35	3.93	25.43	72396317	18490	8375	6072	39244	-24.0	3.0	-21.0
	83	13.08	3.43	0.93	2.03	5.88	31158151	8163	2244	4846	14009	5.2	27.8	33.0
	84	23.93	7.03	1.80	4.19	11.09	55365585	16277	4241	9697	25661	-15.5	39.9	24.4
4VW,FALL	78	59.35	15.86	3.68	9.13	22.49	120865833	32297	7334	18592	45801	-13.3	44.0	30.7
	79	28.39	7.64	1.90	4.85	12.47	75365497	20285	5260	12876	33116	2.4	30.6	33.0
	80	31.47	8.09	1.67	5.53	12.32	83936075	21583	4356	14750	32865	4.7	36.6	41.3
	81	44.54	10.74	2.41	6.67	16.35	105584195	25466	5833	15816	38759	14.8	30.6	45.4
	82	23.55	6.94	1.33	4.55	10.05	62527241	18434	3525	12086	26694	8.2	35.8	44.0
	83	16.33	4.25	0.88	2.82	6.27	43350515	11277	2396	7496	16650	-4.2	36.6	32.3
	84	19.69	4.65	0.82	3.40	6.78	52507909	12414	2229	9073	18093	3.2	44.0	47.2

Table 13. Mean weights and numbers per tow, trawlable abundance and biomass estimates, and survey diagnostics for March 4VsW surveys of American plaice and yellowtail flounder. Note there was no survey in 1998 and incomplete sampling of 4W in 1996. No bootstrapped confidence intervals or survey diagnostics were run on 1986, 1987 and 2000 survey data.

AMERICAN PLAICE (4Vs)

Year	Mean Number per Tow	Mean Weight per Tow (kg)	Standard Error	Lower Confidence Interval	Upper Confidence Interval	Abundance Estimate	Biomass Estimate (metric tons)	Biomass Standard Error	Bootstrap Lower Confidence Interval	Bootstrap Upper Confidence Interval	Set Allocation per Strata Efficiency	Stratification versus Random Efficiency	Overall Efficiency
86	39.02	11.56	10.59			33663777	9969	2274					
87	44.30	14.75	2.23			38223811	12725	1897					
88	45.71	15.45	6.10	6.83	31.55	28076303	9493	3710	4198	19382	-9.2	-2.9	-12.0
89	16.90	4.75	1.19	2.74	7.51	10597507	2976	749	1716	4711	-10.1	-4.4	-14.5
90	33.47	7.59	1.28	5.39	10.31	28448009	6448	1066	4584	8767	17.1	30.4	47.5
91	16.87	3.80	1.08	1.88	6.19	14551582	3282	940	1622	5336	20.6	4.7	25.3
92	20.96	5.11	0.96	3.43	7.09	17817464	4340	815	2918	6029	8.0	39.8	47.8
93	15.72	4.55	1.45	2.59	8.80	13564400	3924	1267	2238	7591	-2.0	9.3	7.3
94	16.17	4.13	2.46	1.27	12.76	13946746	3563	2135	1096	11012	0.3	3.1	3.3
95	14.52	3.97	1.27	2.16	7.95	12529082	3423	1088	1865	6860	5.5	13.0	18.5
96	16.76	4.08	2.11	1.55	10.92	14461378	3518	1783	1338	9425	12.4	3.9	16.3
97	70.22	15.81	7.26	6.56	40.54	60583213	13641	6135	5658	34974	9.3	10.3	19.7
98	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
99	48.10	7.86	1.95	4.94	12.48	41501468	6778	1771	4260	10764	6.1	20.4	26.5
00	64.78	11.54	3.03			55889285	9960	2616					

YELLOWTAIL FLOUNDER (4Vs)

Year	Mean Number per Tow	Mean Weight per Tow (kg)	Standard Error	Lower Confidence Interval	Upper Confidence Interval	Abundance Estimate	Biomass Estimate (metric tons)	Biomass Standard Error	Bootstrap Lower Confidence Interval	Bootstrap Upper Confidence Interval	Set Allocation per Strata Efficiency	Stratification versus Random Efficiency	Overall Efficiency
86	7.92	2.95	1.17			6832540	2542	994					
87	12.18	4.96	5.04			10509412	4281	2140					
88	1.69	0.63	0.41	0.00	1.78	1035687	387	253	0	1095	-15.4	-12.2	-27.6
89	2.30	0.82	0.32	0.34	1.65	1441865	513	188	215	1037	-20.0	27.8	7.8
90	1.34	0.29	0.20	0.00	0.81	1137138	245	175	0	686	-46.8	-7.4	-54.2
91	0.71	0.32	0.22	0.03	1.09	610813	277	190	23	937	-50.3	5.3	-45.0
92	1.68	0.41	0.35	0.01	1.26	1429929	348	294	12	1069	9.7	1.9	11.5
93	0.84	0.30	0.23	0.00	0.73	721784	258	196	0	629	69.8	-0.6	69.2
94	0.24	0.01	0.01	0.00	0.01	203627	6	6	0	12	75.7	0.0	75.7
95	0.75	0.03	0.02	0.01	0.06	646783	26	14	6	51	49.7	40.5	90.1
96	1.41	0.22	0.12	0.01	0.45	1218638	194	105	5	388	-95.5	22.7	-72.8
97	1.15	0.22	0.08	0.08	0.41	995464	186	69	73	356	49.1	11.9	60.9
98	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
99	2.20	0.43	0.19	0.15	0.95	1902246	368	165	132	818	-10.9	10.7	-0.2
00	6.20	0.99	0.69			5348533	857	599					

YELLOWTAIL FLOUNDER (4W)

Year	Mean Number per Tow	Mean Weight per Tow (kg)	Standard Error	Lower Confidence Interval	Upper Confidence Interval	Abundance Estimate	Biomass Estimate (metric tons)	Biomass Standard Error	Bootstrap Lower Confidence Interval	Bootstrap Upper Confidence Interval	Set Allocation per Strata Efficiency	Stratification versus Random Efficiency	Overall Efficiency
86	21.16	4.25	1.12			25839260	5196	1332					
87	34.98	6.43	2.33			42720074	7851	2846					
88	51.56	9.84	2.47	6.13	16.11	62970224	12018	2993	7484	19671	4.0	26.5	30.5
89	17.86	3.21	0.61	2.23	4.61	21806578	3924	749	2730	5634	31.1	35.4	66.4
90	17.16	2.93	0.69	1.83	4.70	20958749	3576	829	2231	5738	34.2	30.6	64.8
91	17.09	2.55	1.48	0.88	8.23	20869045	3116	1775	1069	10057	15.6	5.9	21.5
92	3.46	0.49	0.17	0.25	1.03	4113873	586	207	296	1219	15.6	22.3	37.9
93	31.30	4.98	2.46	1.90	13.11	37222519	5919	2853	2254	15594	-8.8	13.1	4.3
94	17.03	2.48	0.65	1.51	4.27	20797114	3032	785	1846	5210	26.6	26.4	53.0
95	2.92	0.25	0.08	0.13	0.43	3569032	300	94	156	530	10.4	18.4	28.7
96	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-15.9
97	8.86	1.19	0.32	0.64	1.90	10815676	1452	410	781	2319	36.5	9.4	45.9
98	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
99	24.98	3.68	1.45	1.75	8.55	30503231	4499	1843	2136	10439	49.5	8.7	58.2
00	14.39	1.62	0.89			10397772	1976	1090					

Table 14. Catch per unit effort of Danish seiners worked by dedicated fishers (directing for the stipulated species in all years).

American plaice in 4Vn during May

YEAR	RETRANSFORMED MEAN CPUE	VARIANCE	CATCH IN TONS	STANDARDIZED EFFORT
92	0.093	0.168	32	348
93	0.049	0.148	19	390
94	0.061	0.104	52	846
95	0.111	0.262	21	193
96	0.056	0.117	56	993
97	0.088	0.085	116	1324
98	0.056	0.064	128	2303
99	0.071	0.066	147	2076

American plaice in 4Vs during July

YEAR	RETRANSFORMED MEAN CPUE	VARIANCE	CATCH IN TONS	STANDARDIZED EFFORT
93	0.130	0.147	41	316
94	0.152	0.102	101	667
95	0.074	0.266	13	174
96	0.088	0.156	28	321
97	0.093	0.150	42	455
98	0.090	0.089	87	966
99	0.126	0.160	46	364

Yellowtail flounder in 4Vs during July

YEAR	RETRANSFORMED MEAN CPUE	VARIANCE	CATCH IN TONS	STANDARDIZED EFFORT
92	0.197	0.422	11	55
93	0.179	0.124	87	486
94	0.165	0.121	109	663
95	0.258	0.132	142	550
96	0.117	0.206	51	435
97	0.116	0.329	12	103
98	0.053	0.611	2	38

Table 15. Age:Length key for 4VW American plaice, based on 1988 summer research vessel survey (4VsW strata only).

Raw Numbers

Length	Tally	Age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
4	0																					
5	0																					
6	1	1																				
7	2	2																				
8	1	1																				
9	1	1																				
10	4	3	1																			
11	4	2	2																			
12	9	4	3	2																		
13	7	4	3																			
14	10	2	4	4																		
15	10	3	3	4																		
16	11	2	7	1	1																	
17	11		5	6																		
18	10	1	2	4	3																	
19	11		1	8	2																	
20	15		2	8	4	1																
21	20		4	8	7	1																
22	28		4	14	5	4	1															
23	27		4	12	4	3	4															
24	32		1	12	8	3	7		1													
25	36			14	5	4	12		1													
26	38			8	7	11	7	3	2													
27	50			3	14	13	13	4	3													
28	54			2	8	15	20	4	4	1												
29	47				12	7	18	5	4	1												
30	46				1	5	19	8	9	3		1										
31	48		1			13	14	6	8	4	1	1										
32	53			1	4	12	15	9	8	4												
33	34			1	3	8	3	10	5	4												
34	32			1	1	4	7	4	11	2	2											
35	41				1	7	8	11	6	4	3		1									
36	25				2	3	5	3	9	2	1											
37	30				1	7	1	10	5	4	2											
38	17						4	7	2	1	1	1		1								
39	17					1		8	4	1	1	1	1									
40	15					1	3		4	2	1	2		2								
41	12				1			3	2		5	1										
42	14					1		2	1		5	2		2		1						
43	7							1		1	2		1	1	1							
44	9							1	1	1	1		3	1	1							
45	8									2			4			1			1			
46	4										2			2								
47	7					1		1		1	2		1		1							
48	6										1	1	1					1	1		1	
49	6									1	1	1		3								
50	7								1			1	3				1					1
51	2										1							1				
52	4												1		1	1						1
53	3														1				1	1		
54	2													2								
55	2															1		1				
56	1																	1				
57	1																	1				
58	2											1								1		
59	1																1					
60	2																	1	1			
61	2																	1	1			
62	**0**																					
63	1																			1		
64	**0**																					
65	**0**																					
66	2																	1	1			

Proportions (Age:Length Key)

Length	Age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
6	1.000																				
7	1.000																				
8	1.000																				
9	1.000																				
10	0.750	0.250																			
11	0.500	0.500																			
12	0.444	0.333	0.222																		
13	0.571	0.429																			
14	0.200	0.400	0.400																		
15	0.300	0.300	0.400																		
16	0.182	0.636	0.091	0.091																	
17		0.455	0.545																		
18	0.100	0.200	0.400	0.300																	
19		0.091	0.727	0.182																	
20		0.133	0.533	0.267	0.067																
21		0.200	0.400	0.350	0.050																
22		0.143	0.500	0.179	0.143	0.036															
23		0.148	0.444	0.148	0.111	0.148															
24		0.031	0.375	0.250	0.094	0.219		0.031													
25			0.389	0.139	0.111	0.333		0.028													
26			0.211	0.184	0.289	0.184	0.079	0.053													
27			0.060	0.280	0.260	0.260	0.080	0.060													
28			0.037	0.148	0.278	0.370	0.074	0.074	0.019												
29				0.255	0.149	0.383	0.106	0.085	0.021												
30				0.022	0.109	0.413	0.174	0.196	0.065		0.022										
31			0.021		0.271	0.292	0.125	0.167	0.083	0.021	0.021										
32				0.019	0.075	0.226	0.283	0.170	0.151	0.075											
33				0.029	0.088	0.235	0.088	0.294	0.147	0.118											
34				0.031	0.031	0.125	0.219	0.125	0.344	0.063	0.063										
35					0.024	0.171	0.195	0.268	0.146	0.098	0.073		0.024								
36					0.080	0.120	0.200	0.120	0.360	0.080	0.040										
37					0.033	0.233	0.033	0.333	0.167	0.133	0.067										
38							0.235	0.412	0.118	0.059	0.059	0.059		0.059							
39						0.059		0.471	0.235	0.059	0.059	0.059	0.059								
40						0.067	0.200		0.267	0.133	0.067	0.133		0.133							
41					0.083			0.250	0.167		0.417	0.083									
42						0.071		0.143	0.071		0.357	0.143		0.143		0.071					
43								0.143		0.143	0.286		0.143	0.143	0.143						
44								0.111	0.111	0.111	0.111		0.333	0.111	0.111						
45										0.250			0.500			0.125			0.125		
46											0.500			0.500							
47						0.143		0.143		0.143	0.286		0.143		0.143						
48											0.167	0.167	0.167				0.167	0.167		0.167	
49										0.167	0.167	0.167		0.500							
50									0.143			0.143	0.429				0.143				0.143
51											0.500							0.500			
52													0.250		0.250	0.250					0.250
53															0.333					0.333	0.333
54														1.000							
55																0.500		0.500			
56																	1.000				
57																	1.000				
58												0.500							0.500		
59																1.000					
60																	0.500	0.500			
61																	0.500	0.500			
62																	0.500	0.500			
63																			1.000		
64																	0.500	0.500			
65																	0.500	0.500			
66																	0.500	0.500			

Table 16. Age:Length key for 4VW American plaice, based on 1999 spring research vessel survey of 4VsW.

		Raw Numbers																				Proportions (Age:Length Key)																				
		Age																																										
Length	Tally	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
4	3	1	2																				0.333	0.667																				
5	8	3	5																				0.375	0.625																				
6	6	1	5																				0.167	0.833																				
7	10		4	5	1																			0.400	0.500	0.100																		
8	14		6	5	2	1																		0.429	0.357	0.143	0.071																	
9	11		2	8	1																			0.182	0.727	0.091																		
10	13		2	10	1																			0.154	0.769	0.077																		
11	14			6	5	2				1															0.429	0.357	0.143				0.071														
12	12	1		2	4	5																	0.083		0.167	0.333	0.417																	
13	17			3	8	5			1																0.176	0.471	0.294			0.059															
14	29			3	14	10	2																		0.103	0.483	0.345	0.069																	
15	27			2	9	9	6	1																	0.074	0.333	0.333	0.222	0.037																
16	39			2	11	17	7	2																	0.051	0.282	0.436	0.179	0.051																
17	40				15	15	8	2																		0.375	0.375	0.200	0.050																
18	44				7	15	14	3	3	2																0.159	0.341	0.318	0.068	0.068	0.045															
19	45			1	2	18	21	2	1															0.022	0.044	0.400	0.467	0.044	0.022															
20	45				1	18	13	6	5	1	1															0.022	0.400	0.289	0.133	0.111	0.022	0.022													
21	53				6	11	22	9	5																	0.113	0.208	0.415	0.170	0.094															
22	56			1	5	11	21	11	4	3														0.018	0.089	0.196	0.375	0.196	0.071	0.054														
23	52				2	13	27	6	2	2																0.038	0.250	0.519	0.115	0.038	0.038														
24	64				2	21	15	18	4	2		1	1													0.031	0.328	0.234	0.281	0.063	0.031		0.016	0.016											
25	49					9	11	14	9	4	1	1															0.184	0.224	0.286	0.184	0.082	0.020	0.020											
26	55					7	15	10	14	5	4																0.127	0.273	0.182	0.255	0.091	0.073												
27	47			1		8	9	10	6	9	4													0.021		0.170	0.191	0.213	0.128	0.191	0.085												
28	54				1	4	18	11	11	7	1		1												0.019	0.074	0.333	0.204	0.204	0.130	0.019		0.019										
29	48			1		2	10	14	11	6	1	2		1										0.021		0.042	0.208	0.292	0.229	0.125	0.021	0.042		0.021									
30	52					2	12	11	10	7	6	3	1														0.038	0.231	0.212	0.192	0.135	0.115	0.058	0.019										
31	39					2	8	6	6	10	6		1														0.051	0.205	0.154	0.154	0.256	0.154		0.026										
32	37					1	4	7	8	8	4	4		1													0.027	0.108	0.189	0.216	0.216	0.108	0.108		0.027									
33	34						2	4	6	9	5	5	3															0.059	0.118	0.176	0.265	0.147	0.147	0.088										
34	30						1	2	7	7	4	5	3		1													0.033	0.067	0.233	0.233	0.133	0.167	0.100		0.033								
35	28				1		2	3	4	13	3	1	1													0.036		0.071	0.107	0.143	0.464	0.107	0.036	0.036									
36	30						1	2	7	5	4	7	1	3														0.033	0.067	0.233	0.167	0.133	0.233	0.033	0.100									
37	18							3	1	4	5	3	1	1															0.167	0.056	0.222	0.278	0.167	0.056	0.056									
38	20						1	2	1	9	1	3		1	1		1											0.050	0.100	0.050	0.450	0.050	0.150		0.050	0.050		0.050						
39	15							1	2	2	4	2	3	1														0.067	0.133	0.133	0.267	0.133	0.200	0.067										
40	13								2	3	2	3	3																0.154	0.231	0.154	0.231	0.231										
41	11								3	3		2	1	2																0.273	0.273		0.182	0.091	0.182								
42	10						2		1		4		1	2													0.200		0.100		0.400		0.100	0.200									
43	6											2	2	2																		0.333	0.333	0.333								
44	7									1		3	2	1																	0.143		0.429	0.286	0.143							
45	3											1	1		1																		0.333	0.333		0.333							
46	7									1		2	2				1	1													0.143		0.286				0.143	0.143				
47	3										1			2																		0.333			0.667							
48	3													1	1					1															0.333	0.333					0.333		
49	3													2		1																			0.667			0.333				
50	3										1					2																0.333					0.667					
51	2													1						1															0.500					0.500		
52	**0**																														0.250		0.250	0.250							0.250	
53	1									1			1	1							1										0.250			0.250	0.250						0.250	
54	1													1																					1.000							
55	1															1																				1.000							
56	2																			1																				1.000			
57	**0**																																			0.500					0.500		
58	2														1					1																0.500					0.500		
59	**0**																																			0.500					0.500		
60	**0**																																			0.500					0.500		
61	**0**																																			0.500					0.500		
62	**0**																																			0.500					0.500		
63	**0**																																			0.500					0.500		
64	**0**																																			0.500					0.500		
65	**0**																																			0.500					0.500		

Table 17. Comparison of known sample weights versus calculated weights using a length:weight relationship for American plaice, just for samples where the number of fish in the sample equals the number of fish measured.

Year	Mean Sample Weight	Mean Sample Weight Estimated from Length-Weight Equation	Difference	Percent Error	Number of Samples
88	201.6	196.0	5.6	2.8%	13
89	150.4	161.4	-11.0	-7.3%	14
90	194.8	193.9	0.9	0.5%	5
91	101.7	114.5	-12.8	-12.6%	1
92	268.1	271.1	-3.0	-1.1%	2
93	104.9	104.8	0.1	0.1%	5
94	104.1	108.4	-4.3	-4.1%	6
95	87.3	91.9	-4.6	-5.2%	3
96	76.2	78.2	-2.0	-2.6%	4
97	102.2	108.4	-6.3	-6.1%	3
98					
99	117.1	132.8	-15.7	-13.4%	2

Table 18. Determination of multiplication factors to apply to sampled American plaice catch at length data to 'bump' the catch at length up to the commercial landings. All 4Vn otter trawl samples are represented by 1993 sampling. The 4VsW 1995 otter trawl sample is represented by 1994 sampling. Values are in tons.

Combined	Sampled Landings		Commercial Landings		Bump Factors	
	Danish seine	Otter trawl	Danish seine	Otter trawl	Danish seine	Otter trawl
1993	21	64	523	182	25.389	2.857
1994	32	29	593	241	18.493	8.432
1995	38	**29**	527	311	13.980	10.710
1996	27	43	435	473	16.333	10.949
1997	120	9	863	330	7.163	34.954
1998	56	16	893	360	15.809	22.709
1999	49	37	827	442	16.760	11.814

4Vn	Sampled Landings		Commercial Landings		Bump Factors	
	Danish seine	Otter trawl	Danish seine	Otter trawl	Danish seine	Otter trawl
1993	2	1	314	1	180.219	0.966
1994	13	**1**	242	7	17.966	6.823
1995	24	**1**	310	13	13.014	11.906
1996	10	**1**	277	11	28.389	10.366
1997	77	**1**	570	3	7.428	2.469
1998	35	**1**	560	15	16.062	13.236
1999	36	**1**	548	39	15.106	35.189

4VsW	Sampled Landings		Commercial Landings		Bump Factors	
	Danish seine	Otter trawl	Danish seine	Otter trawl	Danish seine	Otter trawl
1993	19	63	209	181	11.100	2.890
1994	19	29	350	234	18.876	8.170
1995	14	**29**	218	298	15.628	10.260
1996	17	43	158	462	9.366	10.685
1997	44	9	292	327	6.696	34.667
1998	22	16	333	345	15.401	21.792
1999	13	37	279	404	21.361	10.783

Table 19.RV catch-at-age of 4VW American plaice since 1988, based on interpolated age:length keys between 1988 and 1999.

SUMMER SURVEY

	Total Numbers of Fish											
Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	2962268	2528524	2357485	2557026	1103658	1714858	3218838	5480888	2787734	1196084	1329858	196671
2	5378483	5798115	7545714	9271387	3638730	3188264	4597956	7497915	4173091	2188852	2706282	960250
3	11680558	12896940	21587245	25362454	11305206	9673734	10480404	13636967	9682562	5631410	8993548	4444578
4	8351893	8996466	14037021	16507313	8191081	7486685	8403759	12900317	9935925	7580436	10935849	10118334
5	8712011	10046378	13690026	17026416	10464441	10461724	11764338	18377609	15386878	13190376	20915641	19568863
6	14922330	17268051	20742456	24647665	16173484	15375017	15713080	22053167	18593879	15721348	25120122	21965615
7	6384297	10039365	10301622	11573842	8747510	8263888	8364007	12156788	11474666	9754030	15511285	13942576
8	8177996	13864765	12510210	12391567	9257975	7632603	7322548	11096652	10321041	8830664	13169804	12091246
9	5199055	10591826	9024593	8898082	7454224	5663013	5341366	8872529	8671975	8324789	11621703	11150636
10	2238185	4644331	4117484	4068628	3474298	2545761	2336856	4133065	4164747	4308707	5675130	5708920
11	1973424	4803149	3789936	3512257	3069011	1935979	1618772	2994914	3113730	3564652	4306288	4527257
12	496843	1475721	1301602	1352961	1352467	834809	739492	1442166	1486348	1834127	2475626	2445375
13	835557	1656525	1243169	1309882	1229727	706676	502326	1030967	1011384	1603571	1296431	1434327
14	753283	1376857	1024075	924437	690300	425081	257533	397189	333912	461182	343558	361687
15	296015	337210	193274	189901	140495	59137	34186	57212	26480	34621	15379	0
16	216553	290150	236404	282499	209140	130327	78154	138044	100651	257860	132380	88328
17	254424	288318	149120	136583	60673	77056	27394	36781	23614	44815	24393	6564
18	242724	206413	159150	116372	80115	43682	23613	18130	19782	21521	519	0
19	80848	219800	158454	146601	127327	84443	52458	84158	91699	209638	40200	38793
20	103351	70878	82656	57390	44158	23181	11478	35439	1838	57848	15403	16528
21	137105	115781	85739	67904	38896	8704	5632	18965	787	15122	2125	0
Total	79397200	107515564	124337434	140401166	86852917	76334621	80894191	122459861	101402721	84831653	124631525	109066549

4VSW COD SURVEY

	Total Numbers of Fish											
Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	534020	2163953	1773119	2157726	693758	681794	3390784	880523	1445679	1397076		421931
2	2001211	2666409	4376837	2632409	1590608	881001	2672598	1207001	2011367	2170703		1802217
3	6695712	4290294	9329435	5949288	4563111	2451090	4193251	2679002	3215363	5770180		3356308
4	4870583	2792095	5877667	4517487	3390792	2174601	3117777	2635235	3514137	7473530		5290326
5	4845019	2815923	6004585	5227556	4301449	3246669	3865648	4602450	4882674	12450691		10931615
6	8529759	4239516	9155592	7884187	6503885	5454138	4844551	6973947	5702106	15889682		12615244
7	3777923	1954733	4432914	4129236	3477268	3286669	2879862	4558843	3444619	10699643		7593782
8	4678544	2436593	4944409	4401279	3669530	3491237	2944677	4417959	3237376	10146149		5987686
9	2979407	1694789	3611030	3501930	2802129	2806846	2498640	3797309	2803090	9585656		5004706
10	1369335	708563	1526850	1561597	1360299	1341568	1207837	1796124	1349192	4676363		2385950
11	1304352	602886	1232013	1204527	1087877	1229331	1132717	1315864	1012900	3534483		1690073
12	312385	248502	415043	467037	461757	531909	508900	618186	462586	1855096		999936
13	752126	220690	293247	419212	407167	500146	465438	544330	368843	1172199		711610
14	571418	173595	324550	237391	200933	243930	227667	197484	83323	334396		147146
15	165191	47080	48917	60422	54542	52991	37605	25837	6183	16459		0
16	233717	91712	38440	65469	57354	67005	134662	68629	79044	174783		77937
17	163157	75110	23784	30520	8884	27842	15223	21908	22642	39867		16828
18	150713	77641	19437	49613	13213	14408	20632	35881	8731	5888		0
19	81126	20509	45198	40942	33317	41220	19520	94980	67895	68769		86113
20	34455	25594	9761	4507	3012	6368	8954	22277	0	4351		19704
21	83103	23612	656	3301	6357	1818	3108	7413	3559	719		0
Total	44133256	27369797	53483483	44545636	34687244	28532581	34190053	36501182	33721309	87466684	0	59139111

Table 20. Commercial removals-at-age of 4VW American plaice since 1993, based on interpolated age:length keys from the 1988 summer 4VW and 1999 March 4VsW surveys.

Total Removals (Numbers of Fish)

Age	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	8	3	0	0
2	45	4	55	27	15	0	0
3	858	1178	2173	510	394	894	623
4	8021	10368	12066	7468	9636	11373	7124
5	36057	36573	39566	22186	20347	22597	12531
6	125495	139383	148869	108127	129118	154329	110341
7	147455	171076	177971	154125	203469	232052	183330
8	272914	290795	285852	278733	360589	393184	316331
9	304566	346373	356504	379939	536840	614622	539592
10	164771	195975	200374	226729	329718	359516	336536
11	197598	225662	214719	270873	364841	384871	385403
12	87516	119003	114216	157909	221664	238324	249529
13	90043	108297	98039	138083	183418	196942	234219
14	38778	53694	39105	50884	54094	50851	54940
15	9348	9824	6416	6011	5284	2608	0
16	12673	19991	17667	25022	30120	31484	50235
17	3200	6649	4842	7121	6935	4616	6485
18	3086	4212	2705	2324	2106	1012	0
19	5676	10565	7999	13471	15592	15684	29356
20	2440	4119	3272	3182	3708	5721	6509
21	1437	2270	1593	1194	1013	739	0

Total Removals (Metric Tons)

Age	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	2	3	3	2	3	4	2
5	13	11	11	7	7	6	2
6	47	49	49	41	50	54	40
7	54	62	60	57	76	80	65
8	115	118	110	117	150	154	128
9	124	142	140	161	225	250	231
10	76	89	87	105	152	159	156
11	105	119	107	142	183	186	193
12	49	68	63	91	123	130	144
13	60	76	66	93	121	134	167
14	26	40	28	36	39	35	43
15	7	8	5	5	4	2	0
16	10	18	16	21	25	26	46
17	3	7	5	7	7	4	5
18	3	5	3	2	3	1	0
19	5	12	9	15	19	18	36
20	3	5	4	4	4	7	8
21	2	3	2	1	1	1	0

Otter Trawl Removals (Metric Tons)

Age	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	1	1	1	1	1	1	1
5	4	4	3	3	1	1	1
6	13	16	15	19	13	15	14
7	16	19	18	25	22	21	22
8	31	37	35	57	43	42	43
9	34	43	44	77	66	67	77
10	19	26	27	55	47	47	52
11	25	34	35	79	54	56	65
12	11	19	20	52	37	41	49
13	14	20	21	54	32	44	65
14	4	9	9	20	8	11	16
15	2	2	2	3	1	1	0
16	3	4	4	12	3	7	17
17	1	2	2	4	1	1	2
18	2	1	1	1	0	0	0
19	2	3	3	8	2	3	15
20	0	1	1	2	0	2	3
21	1	1	0	1	0	0	0

Danish Seine Removals (Metric Tons)

Age	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	2	2	2	2	2	3	2
5	9	7	8	4	5	5	1
6	34	33	34	22	36	39	26
7	38	42	42	32	54	60	43
8	84	81	75	60	107	112	85
9	90	99	96	84	160	183	154
10	57	63	59	51	105	112	104
11	79	85	73	63	130	129	128
12	38	49	42	39	86	89	95
13	46	56	46	39	89	90	102
14	22	30	19	16	31	24	27
15	5	6	4	1	3	2	0
16	8	14	11	9	22	19	30
17	2	5	3	3	6	4	4
18	2	4	2	1	2	1	0
19	4	9	6	7	17	15	21
20	2	4	3	1	4	6	5
21	1	2	2	0	1	1	0

Table 21. Commercial removals-at-age of 4VsW American plaice since 1993, based on interpolated age:length keys from the 1988 summer 4VW and 1999 March 4VsW surveys.

Total Removals (Numbers of Fish)

Age	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	316	1007	1066	233	129	344	413
4	4424	8897	7897	4127	5140	6615	3487
5	20341	31118	24009	13365	9188	11925	7943
6	71368	115969	96902	66631	65301	87037	61695
7	85572	144713	121370	95971	107969	129211	103534
8	154737	235642	200411	180391	191682	224148	176206
9	174518	283028	253503	245348	289968	349333	303827
10	92465	151553	141512	150502	181194	204582	189958
11	109636	162217	149829	186223	195068	212130	216524
12	47406	82065	79799	110497	120133	132916	133867
13	49004	63569	59875	99199	94538	102020	123543
14	19974	32113	24356	35400	25857	26237	30056
15	5594	5113	3550	4696	2574	1313	0
16	6569	9887	9015	17608	11774	13836	22594
17	1481	2843	2536	5017	2205	1708	2771
18	1938	1650	1184	1503	705	481	0
19	2995	4191	3852	8998	4598	6180	12293
20	1137	2254	1109	2426	717	2717	2034
21	871	948	415	949	171	330	0

Total Removals (Metric Tons)

Age	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	1	2	2	1	2	2	1
5	7	9	7	5	3	3	1
6	27	39	33	26	26	31	23
7	31	52	43	37	41	45	37
8	65	93	79	78	81	88	73
9	70	113	100	106	122	140	130
10	42	65	60	72	84	90	88
11	57	80	73	100	97	100	108
12	26	44	42	65	65	71	76
13	33	41	37	67	60	67	83
14	13	21	16	25	17	17	22
15	4	4	3	4	2	1	0
16	5	8	7	15	8	10	19
17	1	3	3	5	2	1	2
18	2	2	1	2	1	1	0
19	3	4	4	10	6	7	15
20	1	3	1	3	1	3	3
21	1	1	0	1	0	0	0

Otter Trawl Removals (Metric Tons)

Age	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	1	1	1	1	1	1	1
5	4	4	4	3	1	1	1
6	13	15	18	18	13	14	13
7	16	19	22	25	22	20	20
8	31	36	43	56	43	41	39
9	34	42	53	75	65	65	70
10	19	25	33	53	46	45	48
11	25	33	42	77	53	54	60
12	11	18	25	51	36	39	45
13	14	19	25	53	31	43	59
14	4	9	11	19	8	10	15
15	2	2	2	3	1	1	0
16	2	4	5	12	3	6	15
17	0	2	2	4	1	1	1
18	2	1	1	1	0	0	0
19	2	3	4	8	2	3	14
20	0	1	1	2	0	2	3
21	1	0	0	1	0	0	0

Danish Seine Removals (Metric Tons)

Age	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	1	2	1	1	1	1	1
5	3	6	3	1	2	2	0
6	13	24	15	8	12	17	10
7	15	33	20	12	20	25	17
8	34	58	36	22	39	47	34
9	36	71	47	31	57	75	60
10	23	40	27	19	38	45	40
11	32	47	31	23	44	46	48
12	15	26	18	14	29	31	31
13	19	22	11	14	29	25	24
14	9	12	5	6	9	6	7
15	2	2	1	1	1	0	0
16	3	4	2	3	6	4	4
17	1	1	1	1	1	1	1
18	0	0	0	0	1	0	0
19	1	1	0	2	3	4	1
20	1	2	0	0	1	2	0
21	0	1	0	0	0	0	0

Table 22. Commercial removals-at-age of 4Vn American plaice since 1993, based on interpolated age:length keys from the 1988 summer 4VW and 1999 March 4VsW surveys.

Total Removals (Numbers of Fish)

Age	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	14	3	0	0
2	316	4	51	47	15	0	0
3	3107	177	1188	356	267	555	165
4	8478	1470	5001	3529	4475	4640	3418
5	26699	5503	18062	9477	11169	10634	3951
6	74972	23450	62606	42608	63666	66466	47147
7	76731	26532	70275	57543	94938	101441	78665
8	130718	54990	108719	96689	167952	166293	138922
9	139672	63374	132660	130989	245343	260929	234199
10	75404	44343	75897	74648	147652	153131	148464
11	80214	63148	83508	82968	169171	171053	169262
12	40512	36536	44202	46699	101172	104098	113613
13	32723	44369	46161	38243	89050	95585	109120
14	15183	21482	18021	15511	28389	24752	24768
15	2782	4641	3309	1305	2731	1301	0
16	6664	10357	10495	8413	18747	19009	29230
17	1656	3866	2826	2507	4863	3109	3864
18	3010	2734	1993	1189	1461	630	0
19	3278	6444	5119	5474	11366	10438	17580
20	931	1854	2275	774	3069	3020	4001
21	516	1334	1238	286	869	425	0

Total Removals (Metric Tons)

Age	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	2	0	1	1	1	1	1
5	7	2	5	3	3	3	1
6	24	10	19	15	24	23	17
7	26	10	23	20	34	35	28
8	52	25	41	38	68	66	55
9	56	29	52	53	103	109	100
10	33	24	34	33	68	69	70
11	42	39	43	42	86	85	85
12	22	24	26	26	58	59	67
13	22	35	35	26	61	68	82
14	10	18	15	12	22	19	21
15	2	4	3	1	2	1	0
16	7	10	11	8	17	17	29
17	2	5	3	3	5	3	3
18	4	3	2	1	2	1	0
19	4	8	6	7	14	13	22
20	1	2	3	1	4	4	5
21	1	2	2	0	1	1	0

Otter Trawl Removals (Metric Tons)

Age	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	1
7	0	0	0	0	0	0	1
8	0	1	1	1	0	1	2
9	0	1	1	1	0	1	4
10	0	1	1	1	0	2	4
11	0	1	2	1	0	2	4
12	0	0	1	1	0	1	3
13	0	1	2	2	0	2	7
14	0	1	1	1	0	1	2
15	0	0	0	0	0	0	0
16	0	1	1	1	0	2	5
17	0	0	0	0	0	0	0
18	0	0	1	0	0	0	0
19	0	0	1	1	0	1	4
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0

Danish Seine Removals (Metric Tons)

Age	1993	1994	1995	1996	1997	1998	1999
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	2	0	1	1	1	1	1
5	7	2	5	3	3	3	1
6	24	9	19	14	24	22	16
7	26	10	22	20	34	35	27
8	52	24	40	37	68	65	53
9	56	28	51	52	102	107	96
10	33	24	32	32	67	68	66
11	41	38	42	40	86	83	81
12	22	23	25	25	58	58	64
13	22	34	33	25	61	66	75
14	10	18	14	11	22	18	19
15	2	4	3	1	2	1	0
16	7	10	9	7	17	15	24
17	2	4	3	2	5	3	3
18	3	3	2	1	2	1	0
19	4	7	5	6	14	12	18
20	1	2	3	1	4	4	5
21	1	2	1	0	1	0	0

Table 23. Mean numbers per tow (not stratified) of Research Vessel survey catches of 4VW yellowtail flounder by year and strata.

Stratum	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
440	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
441	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
442	2.00	0.00	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.67	0.33	0.00	0.00	0.80
443	5.25	2.50	8.50	3.50	2.38	0.67	2.00	0.50	0.00	7.50	0.25	1.00	1.60	1.75	0.00	23.25	8.33
444	0.00	0.50	0.00	0.00	0.17	0.00	0.00	0.00	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
445	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
446	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
447	152.00	129.00	173.50	155.40	232.86	421.00	87.00	988.67	96.75	102.25	113.00	131.50	199.00	85.00	49.50	117.00	26.80
448	50.40	36.50	121.60	63.00	128.40	116.00	55.75	69.50	35.75	91.50	95.50	73.25	78.25	64.50	66.50	20.50	27.80
449	2.50	2.50	0.50	0.00	0.00	0.00	4.50	36.50	7.00	0.00	1.50	3.00	0.00	0.50	1.50	0.00	0.00
450	1.00	24.00	0.67	24.50	13.00	1.00	31.67	7.00	20.00	0.67	0.67	0.00	0.67	8.67	3.00	0.00	1.00
451	0.00	0.00	0.00	0.00	0.00	0.00	4.00	0.50	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
452	0.00	0.00	0.00	0.00	0.50	0.00	1.00	2.00	2.00	0.50	0.00	2.00	0.00	0.50	0.00	0.00	0.00
453	0.00	0.00	0.00	0.00	0.00	0.33	2.00	0.00	0.00	1.33	0.33	0.67	0.33	9.00	0.00	0.00	0.00
454	0.00	16.00	5.00	10.33	3.00	1.00	2.67	20.00	0.00	8.00	27.00	16.00	43.33	4.33	39.00	17.00	13.00
455	213.00	190.83	125.86	129.83	49.57	181.33	161.00	108.29	43.00	111.57	90.71	170.29	77.14	90.00	161.71	82.14	104.63
456	173.40	66.25	98.50	60.00	215.60	64.00	78.75	54.83	232.17	155.50	39.83	141.00	413.50	63.17	120.00	121.83	185.17
457	1.00	3.00	12.50	1.50	0.33	1.50	0.00	0.00	20.00	0.00	1.50	0.00	2.00	0.00	0.00	8.00	9.00
458	70.67	82.00	28.33	23.33	72.33	70.00	231.67	264.67	77.00	346.33	118.00	51.33	27.67	131.67	30.33	197.33	29.40
459	0.33	0.50	7.75	0.50	0.50	2.00	6.25	1.50	2.50	2.25	7.25	0.00	4.00	0.00	0.00	2.67	0.00
460	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	0.00	0.00	0.00	0.00
461	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
462	1.33	0.00	1.00	0.00	0.00	0.50	0.00	3.50	1.75	0.50	0.50	1.00	0.00	0.50	0.00	0.25	0.33
463	2.50	57.00	65.00	33.50	17.00	2.00	2.00	7.00	27.00	0.50	1.50	0.00	5.67	1.00	7.50	0.00	1.00
464	37.00	9.67	26.60	93.67	278.67	23.00	57.80	51.60	2.80	21.80	3.40	32.00	42.75	1.20	6.00	21.80	23.71
465	2.33	12.60	3.40	1.50	0.80	0.00	1.00	1.20	1.40	5.80	0.60	1.43	0.00	0.00	0.40	0.00	1.20
466	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	1.33	0.33	0.00	0.00	0.00	0.00	0.00	0.33

Stratum	87	88	89	90	91	92	93	94	95	96	97	98	99	00
440	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
441	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
442	0.00	0.00	0.60	0.20	16.00	0.17	0.20	0.17	0.00	0.00	0.00	3.00	0.43	1.67
443	0.17	0.00	10.00	1.50	0.00	0.00	0.00	0.33	0.50	2.25	0.22	0.00	3.75	0.00
444	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.63	0.38	0.67
445	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.17
446	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00
447	29.14	45.33	34.67	27.00	21.86	23.86	32.00	42.71	215.86	47.17	607.00	156.43	340.67	102.43
448	5.60	57.20	61.40	14.89	55.67	96.33	9.71	6.43	11.43	11.33	16.57	5.17	24.57	99.50
449	0.50	1.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
450	0.67	7.67	0.00	0.00	0.33	0.33	3.00	1.67	7.67	0.00	0.67	0.00	3.33	2.00
451	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	2.25	0.00	0.00	0.00	0.00
452	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33
453	0.50	0.50	0.00	0.00	0.50	0.00	9.00	3.00	1.00	0.00	3.50	0.00	0.00	0.00
454	21.50	86.50	104.50	39.00	61.50	85.00	34.00	48.00	42.00	8.67	33.50	9.50	9.00	22.50
455	248.13	89.29	159.57	319.92	333.40	231.90	151.22	134.40	60.90	105.80	152.69	55.75	48.27	80.09
456	124.14	65.67	69.17	78.30	151.14	130.57	62.25	30.63	42.00	114.25	35.38	95.67	33.50	24.90
457	2.00	2.00	0.50	0.50	10.50	8.50	0.00	2.00	0.00	0.00	0.00	0.00	3.00	0.00
458	33.80	118.00	38.67	181.78	42.75	57.13	36.25	70.13	12.63	94.43	85.38	400.20	202.67	49.40
459	6.60	0.00	0.00	0.00	0.40	1.33	0.00	0.50	0.50	0.00	0.00	0.83	0.00	0.38
460	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.67	0.00	0.00	0.33	0.00
461	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
462	1.60	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.25	0.00	2.25	3.75	0.00	0.00
463	0.00	3.00	33.50	6.00	0.50	0.00	0.00	10.50	3.00	6.00	0.00	1.50	6.50	2.00
464	13.50	16.00	28.00	43.11	94.71	90.00	70.29	35.71	23.71	21.86	29.75	36.14	8.43	124.14
465	0.50	0.00	0.25	3.33	0.33	0.20	1.90	1.20	2.80	2.10	7.90	0.11	0.80	1.90
466	0.00	0.00	0.00	0.00	0.00	0.00	29.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 24(a). Stratified mean weights and numbers per tow, trawlable abundance and biomass estimates, and associated bootstrapped standard errors, 95% confidence intervals and survey design efficiency estimates for 1970-2000 4VW yellowtail flounder. The total, pre-recruit, and fishery-sized numbers per tow are independent estimates. Differences between total and sums of pre-recruit + fishery-sized numbers can result from discrepancies between fish counts and length frequency tallies.

Year	Mean Number per Tow	Mean Pre-recruits per Tow	Mean Fishery-sized per Tow	Mean Weight per Tow (kg)	Standard Error	Lower Confidence Interval	Upper Confidence Interval	Abundance Estimate	Biomass Estimate (metric tons)	Biomass Standard Error	Bootstrap Lower Confidence Interval	Bootstrap Upper Confidence Interval	Set Allocation per Strata Efficiency	Stratification versus Random Efficiency	Overall Efficiency
70	32.08	21.33	9.59	7.12	1.69	4.66	11.59	85155750	18905	4495	12371	30771	6.5	33.0	39.5
71	26.99	17.99	8.43	5.74	1.39	3.22	8.61	71985039	15303	3736	8585	22976	4.2	36.3	40.5
72	28.40	14.47	12.34	7.51	1.33	5.37	10.72	75746548	20040	3605	14318	28590	12.4	40.6	53.1
73	29.27	20.92	12.42	6.99	1.65	4.57	11.01	78069371	18634	4383	12184	29370	7.8	32.1	40.0
74	42.50	24.44	17.48	10.29	1.85	7.09	14.14	108525574	26271	4892	18116	36098	2.0	42.8	44.7
75	48.13	41.52	14.96	10.19	3.01	6.42	18.60	128378865	27169	7803	17126	49622	-2.2	29.9	27.6
76	34.08	24.63	15.17	8.70	1.61	5.74	12.09	81258297	20738	3841	13696	28826	13.5	32.8	46.4
77	79.00	61.43	26.23	18.60	4.61	12.69	28.16	210721696	49608	12133	33848	75106	-15.9	69.2	53.3
78	19.96	7.16	13.86	6.11	1.98	3.01	11.05	53007317	16229	5168	7989	29336	38.7	12.4	51.1
79	29.91	14.10	15.79	8.36	1.49	5.74	11.84	79774696	22311	3982	15322	31576	15.0	37.9	52.9
80	20.08	7.00	13.23	5.97	0.88	4.34	7.67	53555213	15921	2432	11568	20448	3.6	56.5	60.1
81	29.83	15.33	16.62	8.04	1.05	6.25	10.35	79568691	21435	2827	16677	27605	7.9	60.1	68.0
82	34.76	9.33	25.67	11.02	2.96	6.52	18.91	92279174	29254	7820	17308	50199	31.6	20.6	52.2
83	17.96	7.56	9.98	4.90	0.78	3.35	6.40	47900431	13058	2026	8927	17083	2.9	56.9	59.8
84	21.83	11.67	10.29	5.25	0.96	3.55	7.42	58236449	14004	2561	9459	19791	3.7	47.1	50.9
85	22.77	9.73	12.94	6.20	0.93	4.25	8.00	60738704	16542	2508	11328	21335	-0.9	58.2	57.3
86	18.45	12.17	6.93	4.00	0.71	2.80	5.61	49219192	10668	2037	7463	14965	8.2	34.6	42.8
87	24.86	19.46	5.62	4.52	1.10	3.06	7.47	66306187	12069	2879	8154	19928	2.4	36.1	38.5
88	18.20	9.13	9.68	4.79	0.56	3.61	5.83	48543798	12773	1464	9633	15543	3.3	64.5	67.8
89	22.21	14.12	8.45	5.24	0.87	3.61	7.05	59234560	13967	2280	9626	18798	4.1	45.5	49.6
90	33.39	27.57	5.43	5.57	0.88	4.24	7.63	85804162	14317	2194	10908	19613	12.2	47.7	59.9
91	39.07	32.41	8.29	7.86	2.20	4.90	14.62	104208159	20972	5655	13058	38998	15.7	22.9	38.6
92	31.09	22.94	7.37	6.03	1.27	4.03	8.94	82926140	16095	3393	10760	23853	11.7	27.9	39.7
93	18.07	14.66	2.72	2.72	0.50	1.83	3.82	48210295	7268	1392	4886	10190	13.4	33.1	46.4
94	16.76	14.66	2.75	2.55	0.58	1.80	4.40	44716840	6813	1548	4807	11743	9.9	26.9	36.8
95	19.28	15.30	3.94	3.15	1.24	1.62	7.37	51420220	8406	3172	4326	19647	6.8	19.6	26.4
96	16.86	14.97	1.85	2.33	0.55	1.52	3.78	44966097	6203	1457	4064	10088	19.4	22.2	41.5
97	48.13	39.44	7.39	8.16	4.39	2.12	22.05	123627087	20948	10840	5454	56628	7.2	12.2	19.5
98	25.55	21.79	3.82	3.64	1.20	1.83	7.13	68159294	9709	3142	4883	19022	14.4	22.1	36.6
99	28.78	24.37	3.76	4.34	1.46	1.98	8.07	74791393	11291	3891	5141	20973	-2.1	33.3	31.2
00	22.60	21.68	0.65	3.03	0.50	2.12	4.09	60273601	8069	1333	5666	10904	6.1	38.8	44.9

Table 24(b). Stratified mean weights and numbers per tow, trawlable abundance and biomass estimates, and associated bootstrapped standard errors, 95% confidence intervals and survey design efficiency estimates for 1970-2000 4Vs yellowtail flounder. The total, pre-recruit, and fishery-sized numbers per tow are independent estimates. Differences between total and sums of pre-recruit + fishery-sized numbers can result from discrepancies between fish counts and length frequency tallies.

Year	Mean Number per Tow	Mean Pre-recruits per Tow	Mean Fishery-sized per Tow	Mean Weight per Tow (kg)	Standard Error	Lower Confidence Interval	Upper Confidence Interval	Abundance Estimate	Biomass Estimate (metric tons)	Biomass Standard Error	Bootstrap Lower Confidence Interval	Bootstrap Upper Confidence Interval	Set Allocation per Strata Efficiency	Stratification versus Random Efficiency	Overall Efficiency
70	29.62	18.87	10.52	9.19	3.27	4.62	17.35	26838858	8327	2990	4185	15724	-3.5	39.5	36.1
71	24.95	15.82	8.72	7.58	2.62	3.75	11.74	22921176	6964	2411	3445	10784	-20.2	52.5	32.3
72	40.87	26.65	12.12	12.92	3.54	7.00	21.34	37544894	11874	3184	6428	19604	3.4	40.0	43.5
73	38.98	37.42	11.72	10.74	4.04	5.31	21.51	35814269	9866	3646	4880	19759	3.5	30.3	33.8
74	52.77	37.18	15.79	14.54	4.06	7.55	23.52	48481066	13359	3743	6940	21607	-1.8	36.3	34.6
75	75.06	52.12	20.56	17.19	3.80	9.55	24.29	68960472	15792	3454	8770	22314	-5.0	65.7	60.8
76	25.89	13.57	11.71	8.70	1.59	5.90	12.13	18645565	6270	1150	4247	8741	-0.7	60.5	59.8
77	177.20	167.95	31.67	41.46	12.91	25.88	68.02	162792516	38093	11994	23773	62487	-17.6	67.4	49.8
78	19.80	9.75	9.65	6.65	3.14	2.13	14.18	17944551	6030	2777	1935	12856	-7.7	20.2	12.5
79	23.98	10.76	10.35	8.83	2.38	4.43	13.41	22028994	8112	2309	4067	12320	-9.1	43.2	34.1
80	30.38	16.30	16.72	10.10	2.23	6.19	14.92	27905496	9281	2033	5687	13709	-0.5	58.8	58.3
81	33.25	24.38	13.59	10.61	2.31	6.91	16.11	30542010	9744	2170	6346	14800	-3.7	61.8	58.1
82	40.49	17.18	23.43	15.14	4.77	7.88	26.68	36700497	13720	4401	7143	24188	-12.2	40.5	28.2
83	20.86	9.00	11.00	7.24	1.65	3.99	10.50	19160196	6648	1567	3666	9644	-7.5	57.9	50.4
84	16.16	5.95	10.01	5.98	1.94	2.73	10.73	14844458	5492	1802	2506	9856	-8.3	38.4	30.1
85	22.39	7.97	13.86	8.51	2.41	3.48	12.49	20568015	7823	2127	3201	11471	-10.1	51.6	41.5
86	8.86	2.36	6.61	3.62	1.58	1.23	7.54	8136158	3325	1429	1134	6924	-10.3	8.9	-1.4
87	5.32	2.10	3.42	2.12	0.61	0.97	3.41	4889945	1950	571	889	3131	4.4	46.6	51.0
88	15.33	5.53	10.56	6.05	1.18	3.68	8.27	14083289	5554	1109	3383	7595	3.5	58.5	62.0
89	15.15	5.41	10.34	6.05	2.20	2.22	10.76	13915625	5562	1969	2043	9888	3.8	23.5	27.3
90	6.25	1.35	4.97	2.61	0.74	1.46	4.43	5745522	2399	692	1340	4070	13.3	31.4	44.7
91	11.03	4.16	7.19	4.20	1.91	1.29	9.35	10129997	3863	1754	1185	8592	12.3	16.9	29.2
92	16.00	7.61	7.95	5.69	2.72	2.19	13.13	14698654	5226	2491	2007	12060	7.1	19.3	26.4
93	6.13	3.90	2.13	1.79	0.90	0.31	3.84	5632440	1648	817	283	3525	9.1	16.5	25.5
94	7.55	6.38	1.28	1.84	1.46	0.16	4.04	6935344	1691	1384	144	3711	10.5	1.1	11.6
95	34.11	31.15	3.03	6.08	3.36	1.74	16.46	31332755	5589	3110	1595	15126	8.7	18.3	27.0
96	8.84	7.72	1.11	1.91	0.72	0.82	3.77	8121809	1750	700	756	3461	-2.9	29.8	26.9
97	100.79	91.63	6.11	19.32	13.05	0.82	56.43	82627821	15842	10786	672	46262	6.2	11.1	17.3
98	24.17	20.53	3.60	5.79	3.30	1.43	16.28	22204422	5315	2917	1317	14952	11.8	20.4	32.2
99	54.91	52.01	3.02	9.33	4.13	2.74	19.54	50440583	8573	3823	2516	17952	0.6	32.2	32.7
00	28.41	26.27	1.65	4.41	1.22	2.45	7.05	26098136	4053	1125	2249	6476	6.4	34.6	41.0

Table 24(c). Stratified mean weights and numbers per tow, trawlable abundance and biomass estimates, and associated bootstrapped standard errors, 95% confidence intervals and survey design efficiency estimates for 1970-2000 4W yellowtail flounder. The total, pre-recruit, and fishery-sized numbers per tow are independent estimates. Differences between total and sums of pre-recruit + fishery-sized numbers can result from discrepancies between fish counts and length frequency tallies.

Year	Mean Number per Tow	Mean Pre-recruits per Tow	Mean Fishery-sized per Tow	Mean Weight per Tow (kg)	Standard Error	Lower Confidence Interval	Upper Confidence Interval	Abundance Estimate	Biomass Estimate (metric tons)	Biomass Standard Error	Bootstrap Lower Confidence Interval	Bootstrap Upper Confidence Interval	Set Allocation per Strata Efficiency	Stratification versus Random Efficiency	Overall Efficiency
70	39.68	34.56	3.44	7.17	2.26	4.27	15.18	58091951	10503	3356	6244	22216	15.8	27.7	43.5
71	33.52	30.56	2.17	5.70	1.98	2.54	10.40	49063863	8339	2854	3716	15225	15.0	27.5	42.5
72	25.89	21.04	3.29	5.50	1.18	3.67	8.48	37905678	8048	1688	5367	12409	21.9	31.9	53.8
73	28.87	26.37	3.55	5.99	1.64	3.48	10.19	42255103	8768	2433	5099	14914	6.4	32.5	39.0
74	44.48	36.18	7.07	9.56	2.27	4.85	13.68	60044508	12912	3150	6550	18463	-4.4	50.1	45.7
75	40.59	55.43	1.87	7.77	4.56	2.20	20.00	59418393	11377	6997	3227	29283	-1.3	5.8	4.5
76	42.77	44.62	7.78	9.88	2.47	5.91	16.21	62612733	14468	3665	8645	23735	16.0	27.6	43.6
77	32.74	30.51	3.93	7.87	1.30	5.13	10.13	47929180	11515	1834	7513	14834	9.8	64.0	73.7
78	23.95	17.20	8.91	6.97	3.03	3.21	15.66	35062766	10199	4358	4705	22918	46.6	11.0	57.6
79	39.40	33.04	8.13	9.68	2.23	5.97	14.83	57681125	14167	3244	8733	21710	22.7	35.1	57.8
80	17.52	13.04	3.09	4.54	0.89	3.00	6.37	25649718	6640	1335	4393	9324	12.7	43.2	56.0
81	33.49	28.61	5.78	7.99	1.27	5.68	10.40	49026681	11692	1813	8320	15227	17.8	56.8	74.5
82	37.91	26.99	11.29	10.58	4.40	4.57	23.41	55495107	15492	6464	6688	34272	44.0	14.3	58.3
83	19.61	17.13	2.26	4.38	0.86	2.85	6.27	28702848	6410	1285	4167	9175	12.5	53.4	65.9
84	29.64	26.02	3.98	5.82	1.24	3.76	8.70	43391992	8512	1820	5498	12736	9.7	51.0	60.7
85	27.44	23.20	4.42	5.96	0.91	4.45	8.15	40170689	8720	1328	6509	11931	10.4	63.9	74.3
86	28.00	26.76	2.35	5.00	0.99	3.32	7.21	40982750	7318	1451	4866	10552	17.2	43.4	60.5
87	41.96	39.79	2.45	6.91	1.94	4.47	12.94	61416243	10119	2822	6548	18947	5.1	33.5	38.6
88	23.54	20.99	3.19	4.93	0.64	3.79	6.24	34460509	7220	956	5545	9129	6.7	68.1	74.9
89	30.91	28.93	2.26	5.71	0.76	4.29	7.22	45243722	8355	1149	6283	10574	5.3	68.5	73.8
90	58.59	56.35	1.45	8.71	1.52	6.38	12.78	80033569	11893	2082	8712	17456	9.9	46.4	56.3
91	62.82	63.03	2.43	11.58	3.72	6.78	23.99	91951340	16954	5374	9930	35117	16.0	22.0	38.0
92	46.60	44.21	1.25	7.42	1.58	4.89	11.36	68207754	10868	2304	7153	16628	17.7	33.4	51.1
93	29.07	27.46	0.41	3.84	0.76	2.58	5.45	42553501	5620	1127	3777	7971	15.5	36.7	52.2
94	25.79	25.80	0.31	3.50	0.49	2.59	4.50	37759297	5121	694	3791	6591	12.6	58.2	70.8
95	13.72	13.36	0.24	1.92	0.43	1.35	3.15	20087465	2817	621	1976	4613	18.6	27.4	46.0
96	25.17	25.00	0.11	3.04	0.94	1.76	5.71	36844289	4453	1278	2578	8361	26.0	19.5	45.6
97	28.01	27.17	0.26	3.49	0.72	2.23	5.05	40999266	5106	1086	3264	7389	26.0	31.9	57.9
98	31.14	31.03	0.22	2.97	0.83	1.73	5.07	45581576	4344	1167	2527	7418	27.4	28.3	55.8
99	17.42	16.60	0.10	1.94	0.52	1.12	3.20	24299771	2711	726	1562	4469	37.2	23.0	60.2
00	23.12	22.69	0.15	2.72	0.49	1.89	3.93	33850861	3982	714	2764	5747	10.9	43.5	54.3

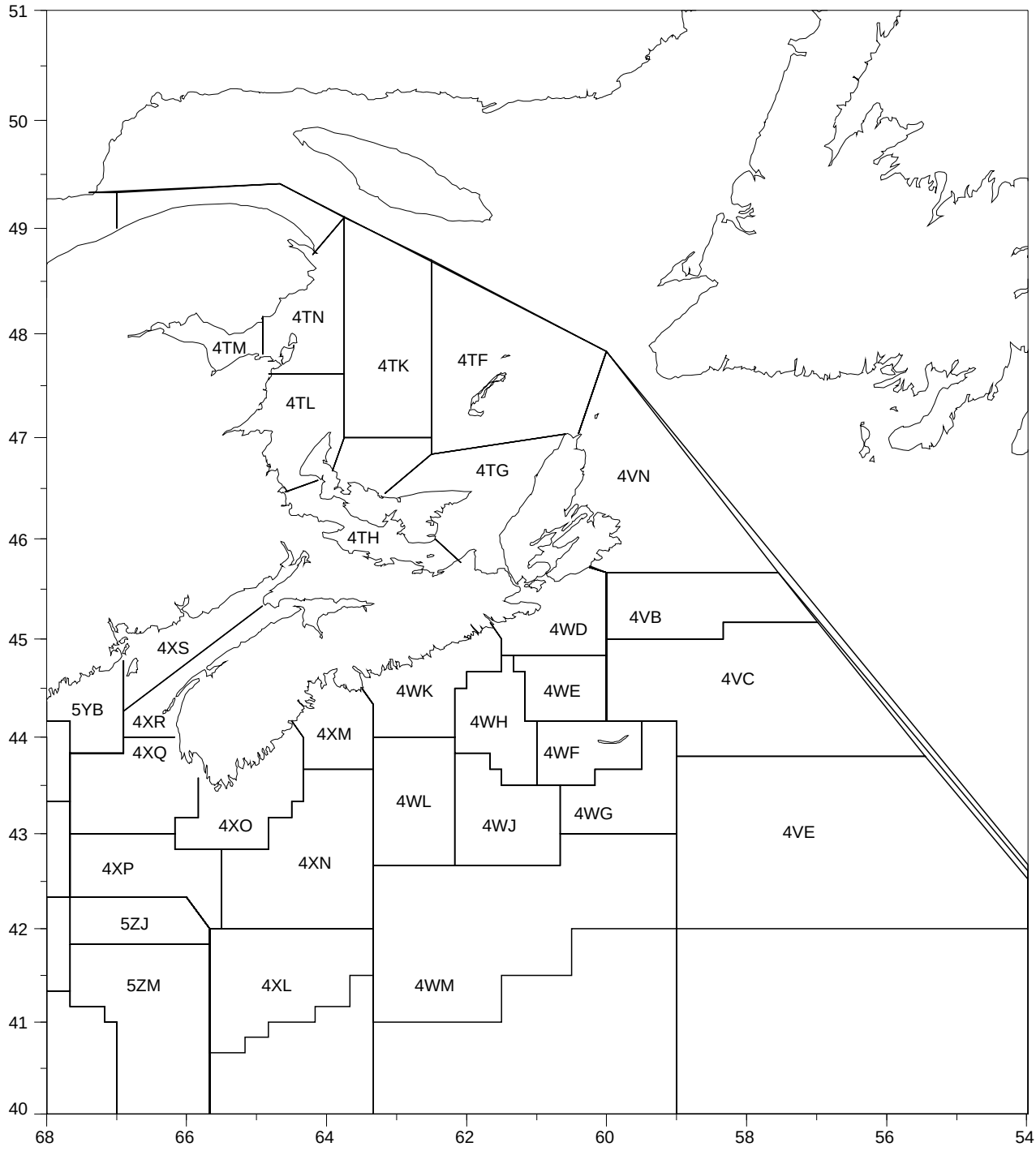


Figure 1. North Atlantic Fisheries Organization (NAFO) unit areas referred to in this paper.

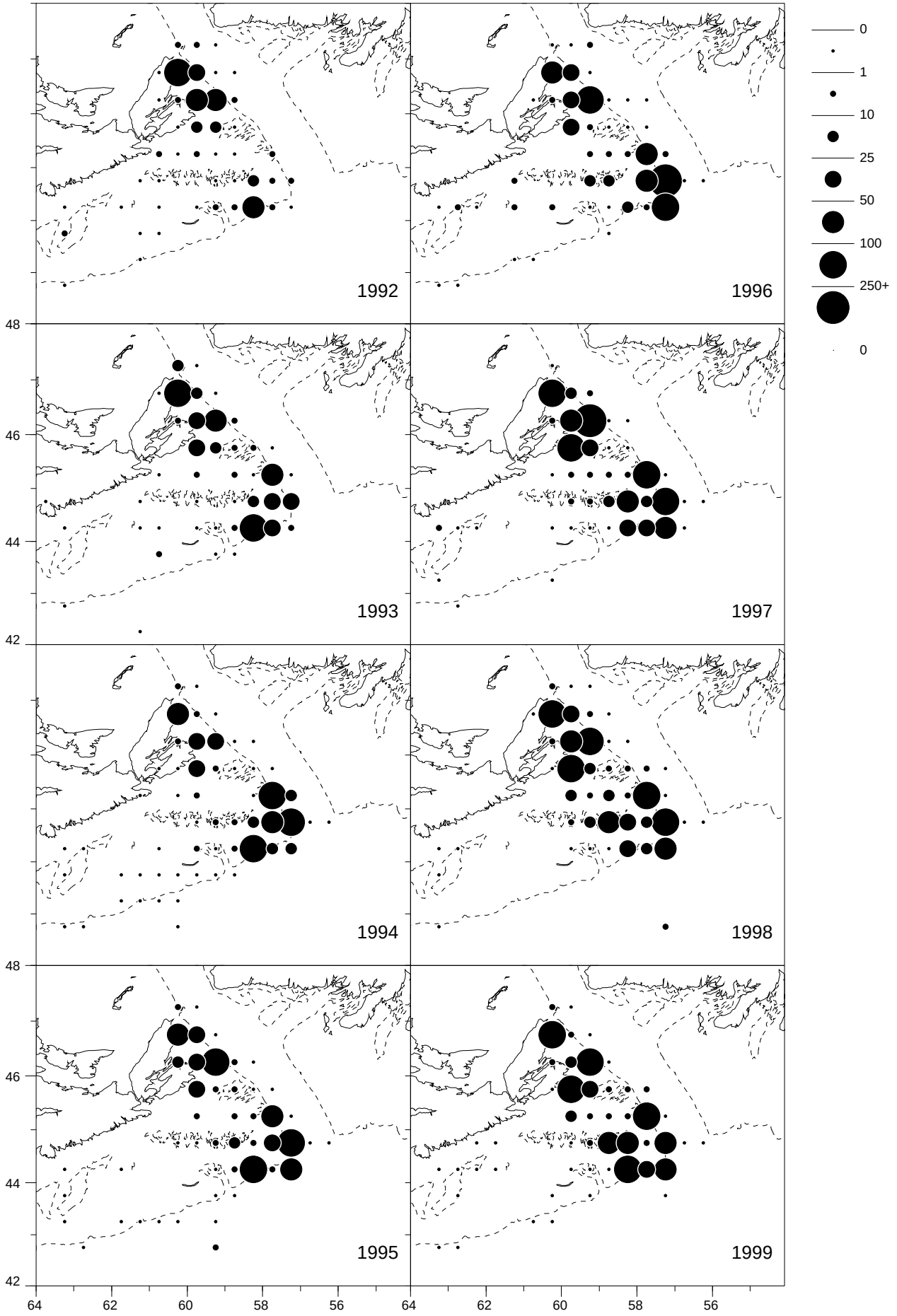


Figure 2. Distribution of the adjusted Scotia-Fundy Commercial Landings (metric tons) of 4VW American plaice, aggregated by 5-minute squares.

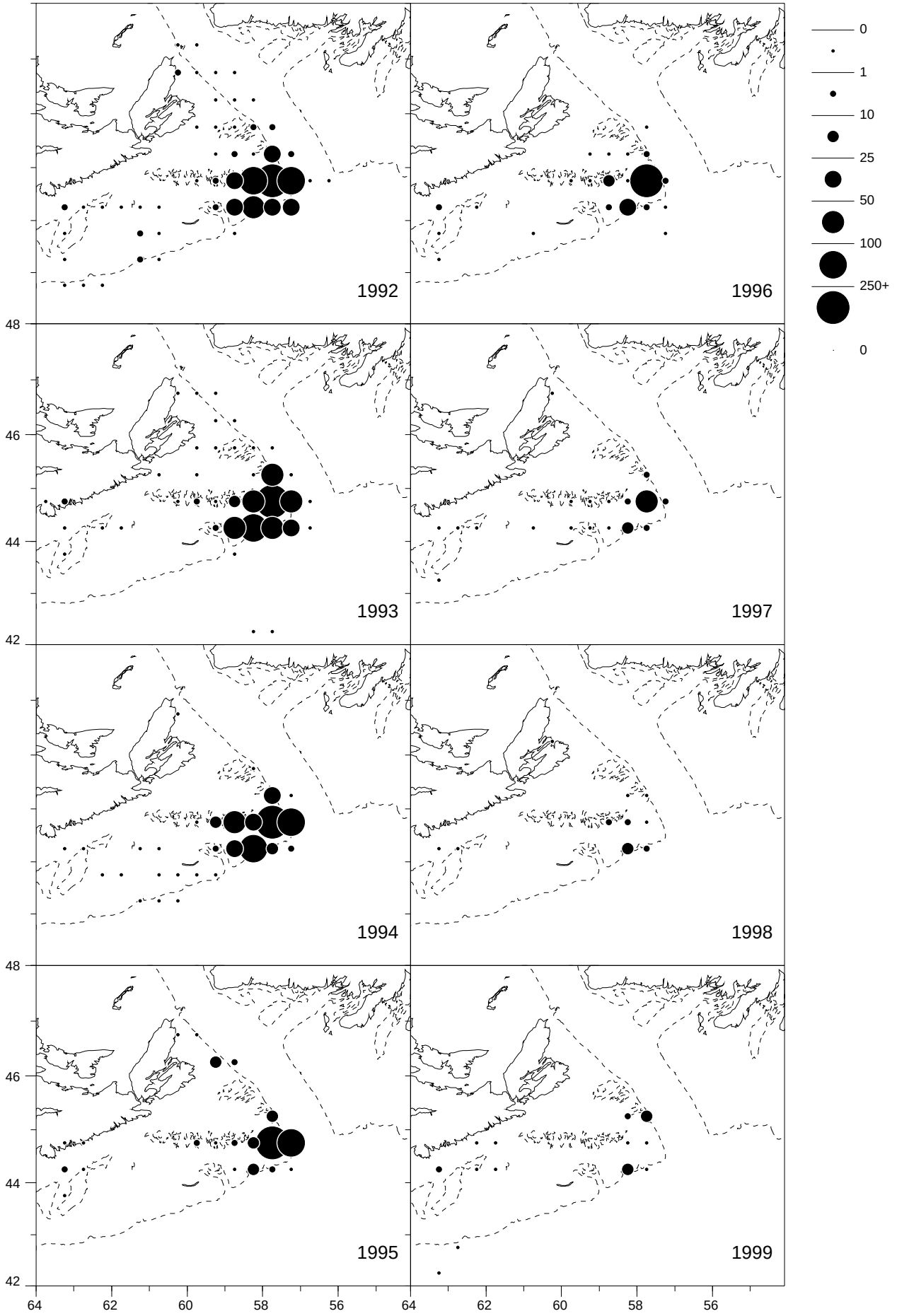


Figure 3. Distribution of the adjusted Scotia-Fundy Commercial Landings (metric tons) of 4VW yellowtail flounder, aggregated by 5-minute squares.

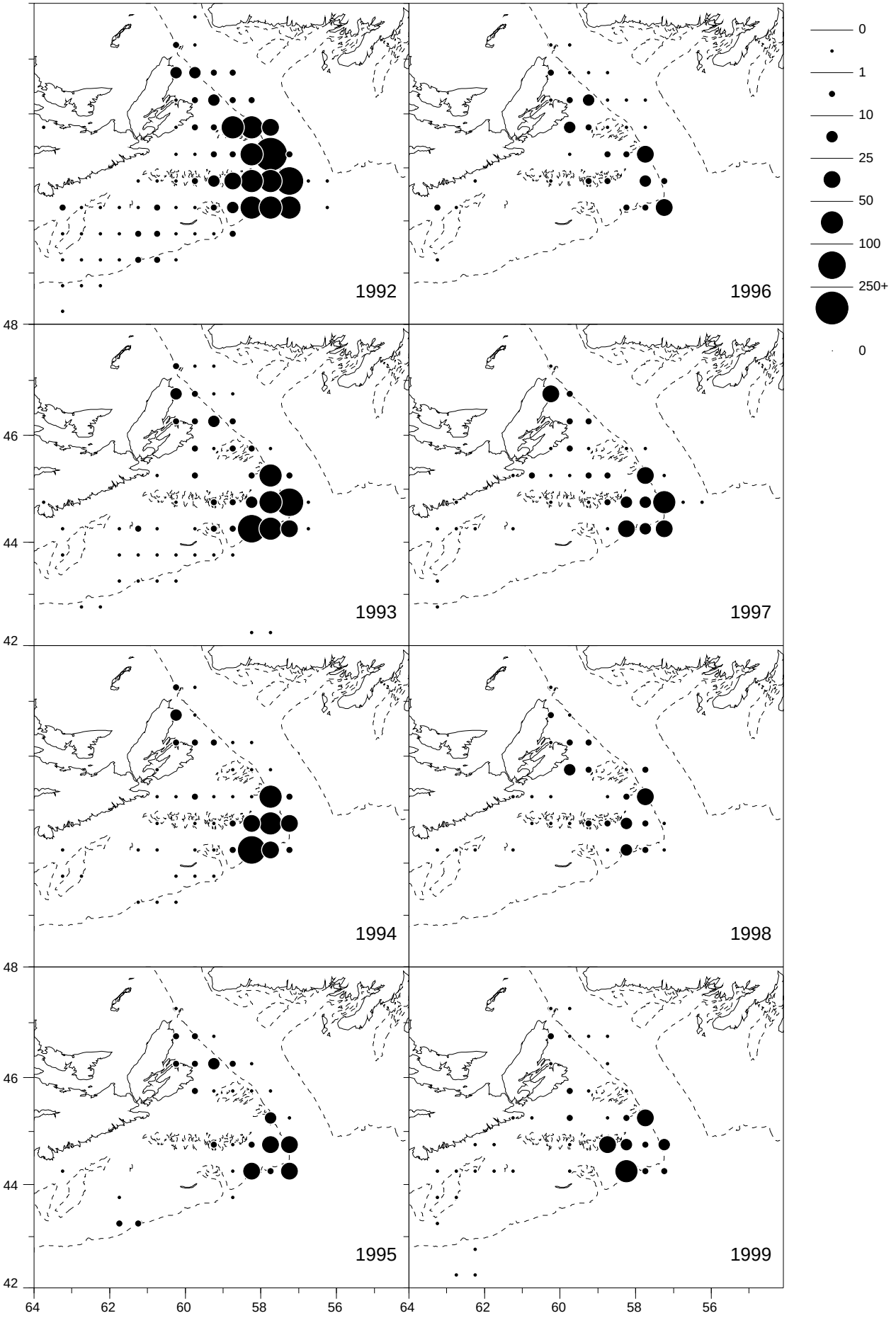
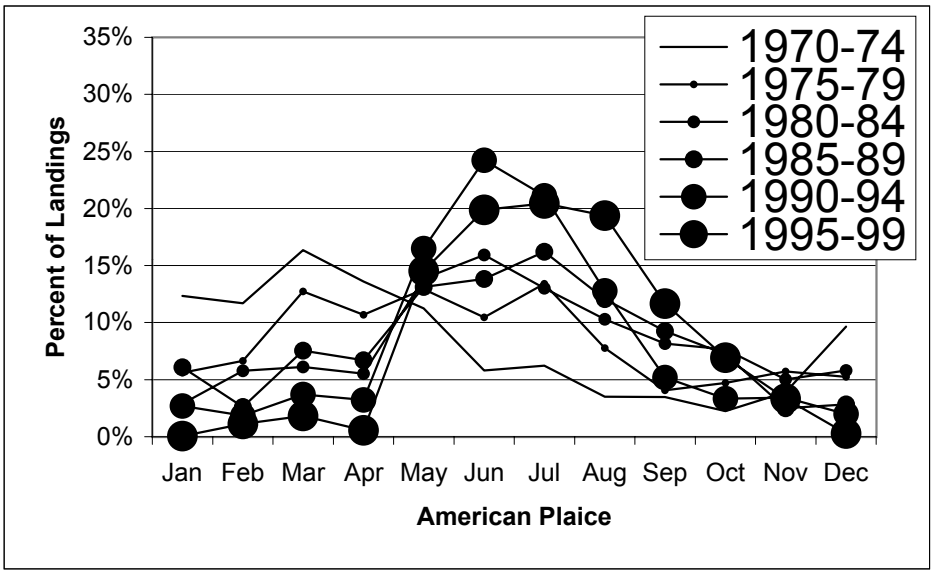
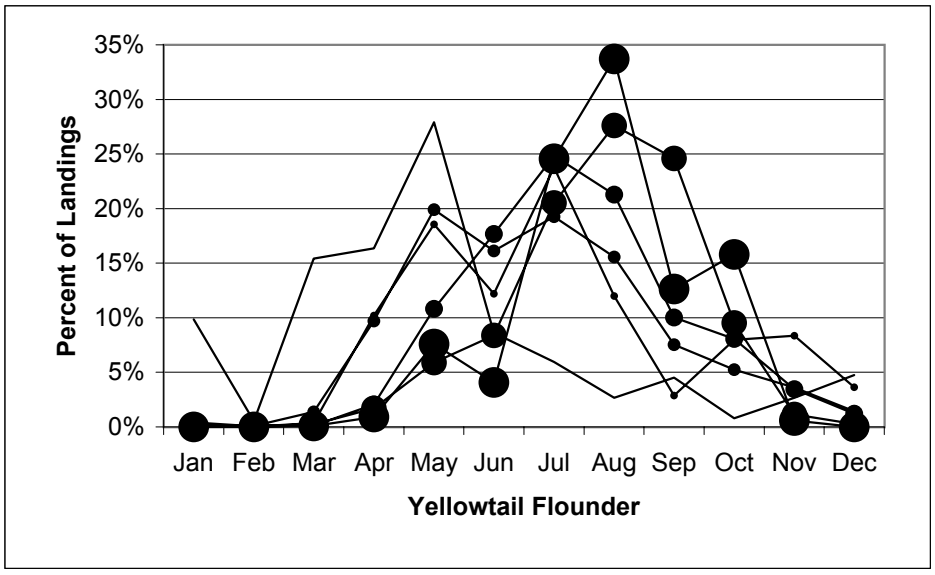


Figure 4. Distribution of the adjusted Scotia-Fundy Commercial Landings (metric tons) of 4VW unspecified flounder, aggregated by 5-minute squares.





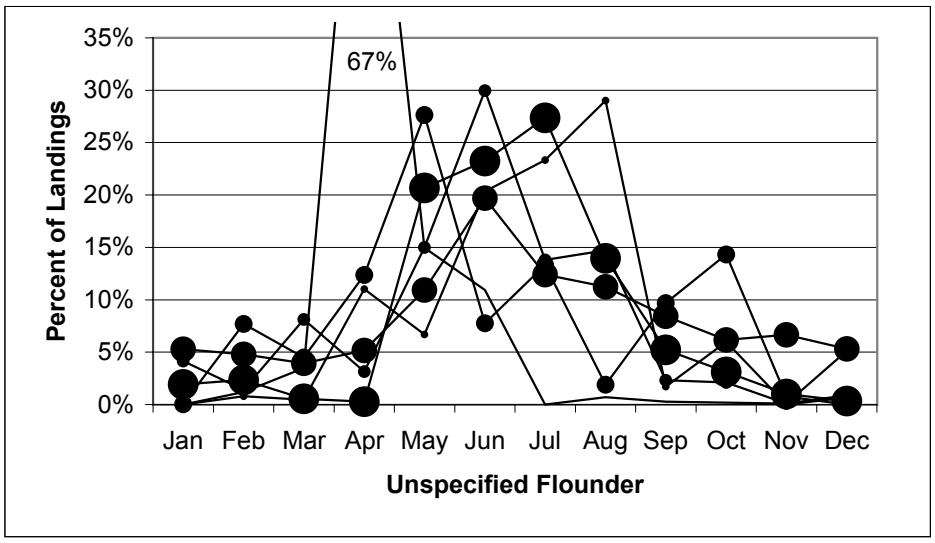


Figure 5. Monthly distribution of 4VW landings, expressed in percents, of American plaice, yellowtail flounder and unspecified flounder, aggregated over 5-year blocks of years. Adjusted landings were used for 1992-1999. The succession of time periods is represented by expanding symbols.

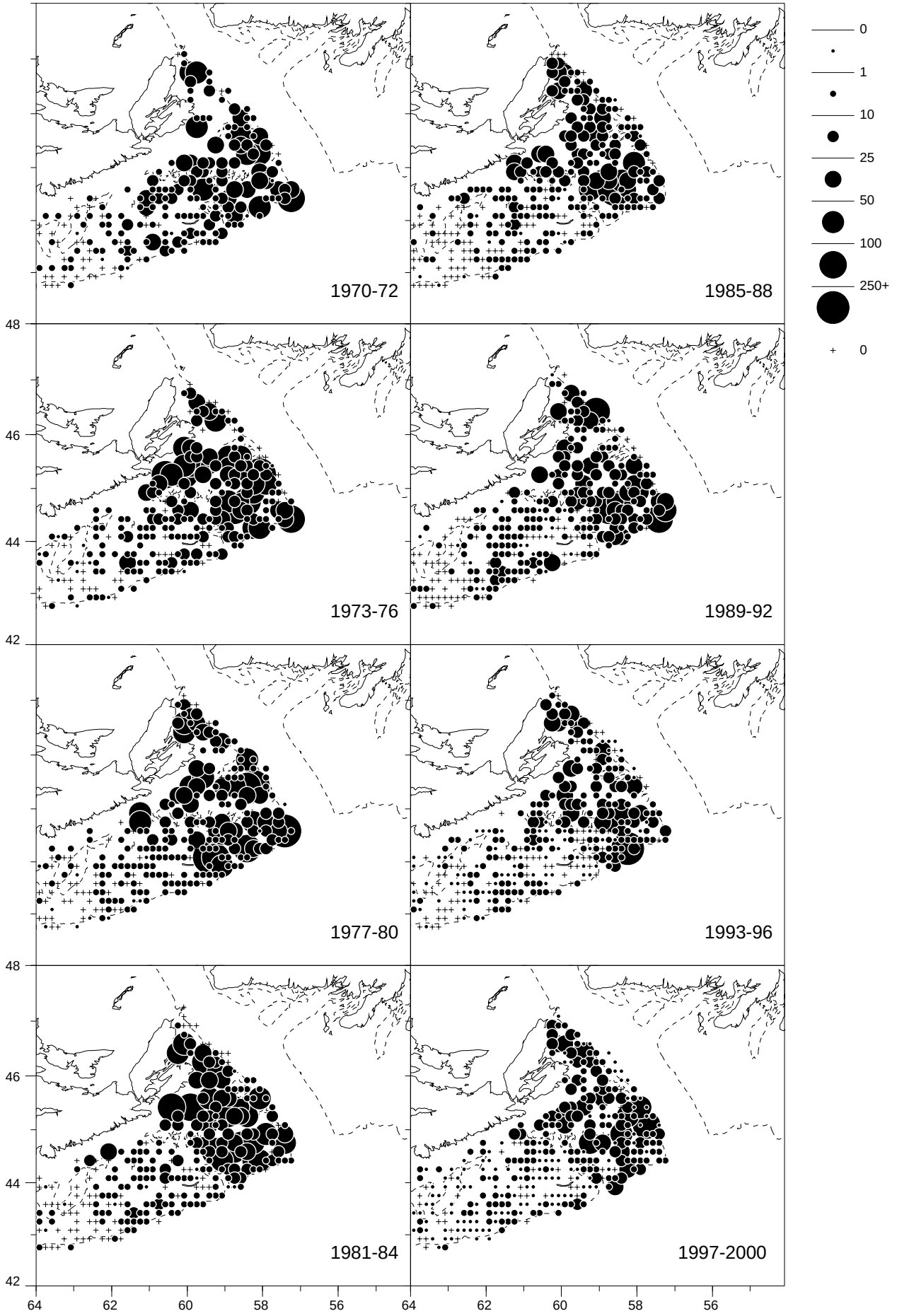


Figure 6. American plaice distributions (catch in kgs) from summer research vessel surveys. The catches are averaged over years within 10 minute squares.

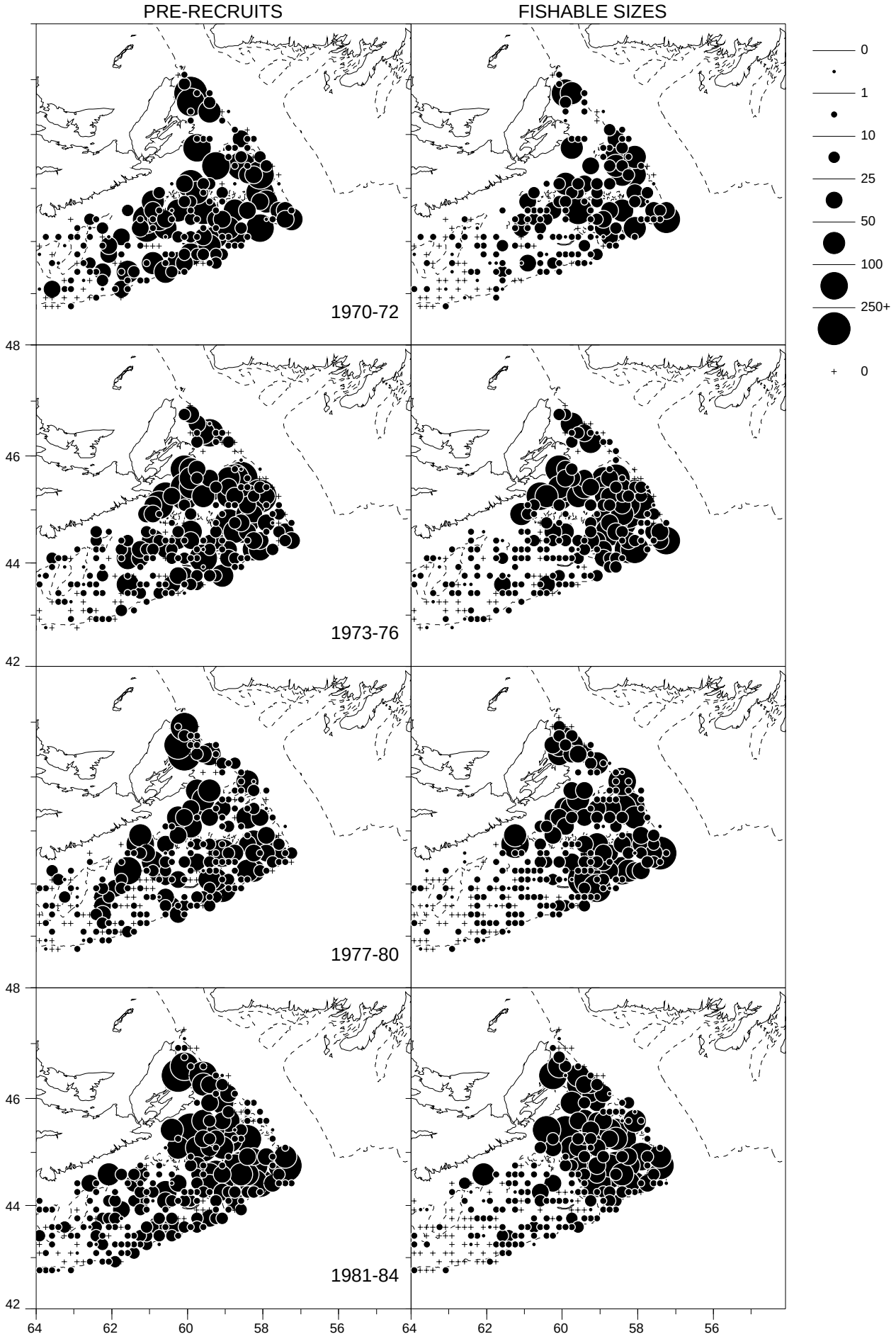


Figure 7 a). Distributions, in total numbers, of pre-recruited (30cm or smaller) and fishery-sized American plaice from summer research vessel surveys. The catches are averaged over years within 10 minute squares.

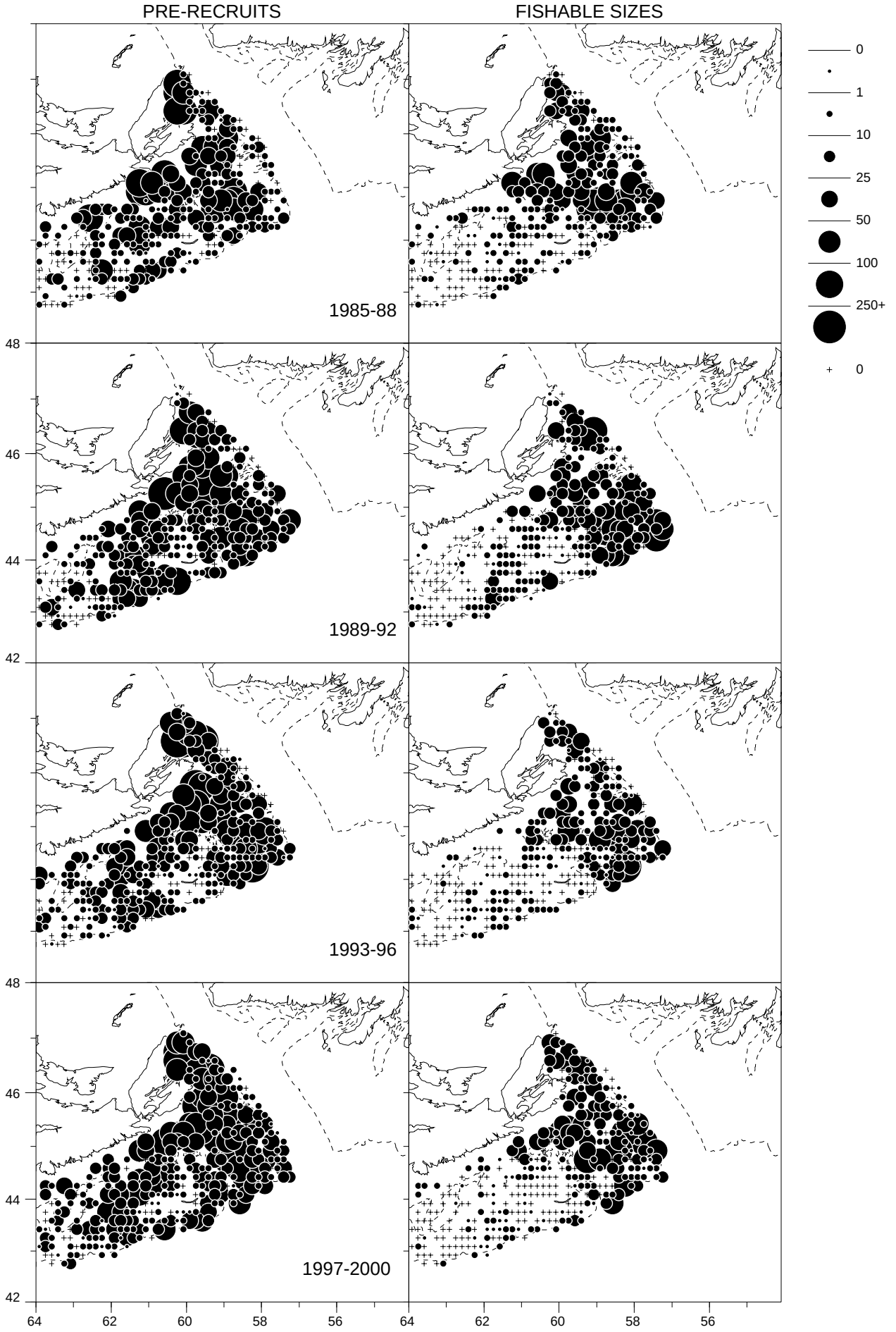


Figure 7 a) (con't).

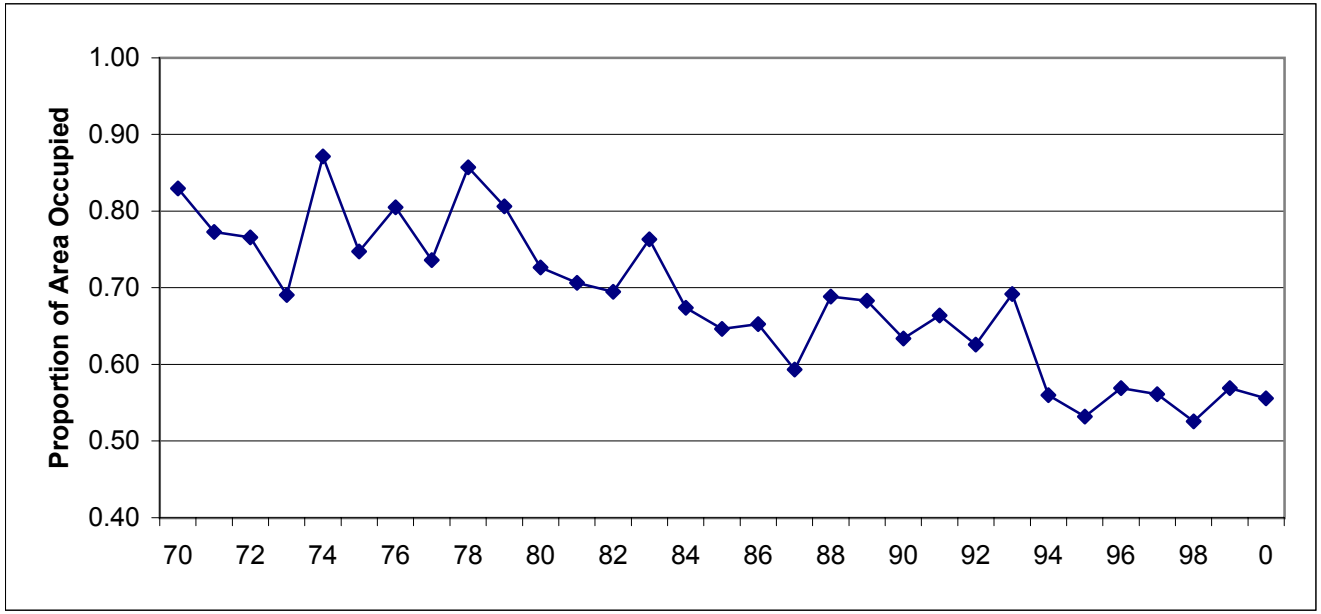


Figure 7 b). Proportion of sets with non-zero catches of fishery-sized American plaice in the 4VW survey area.

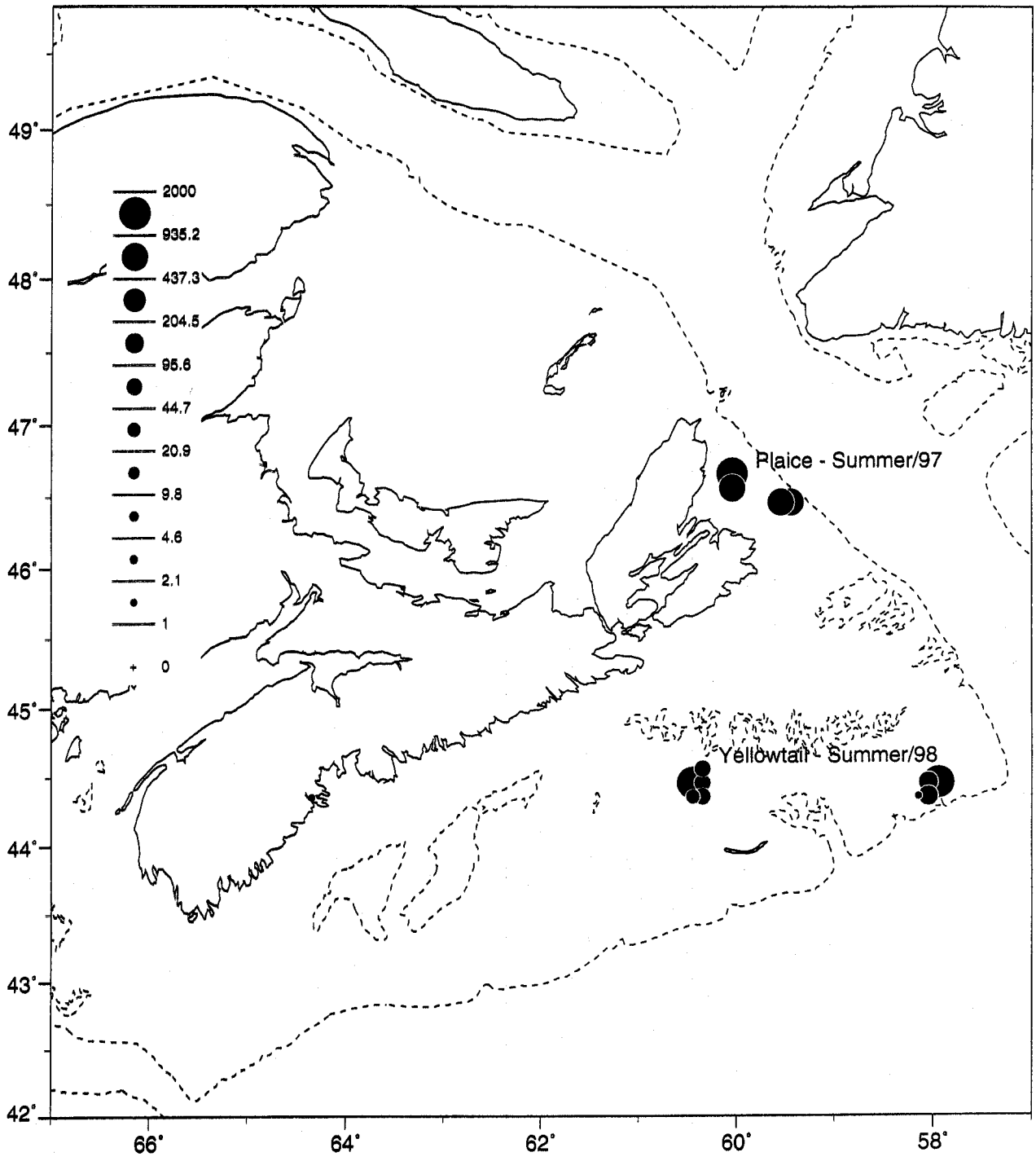


Figure 8. Locations and quantities of ITQ-DFO tagging of American plaice and yellowtail flounder.

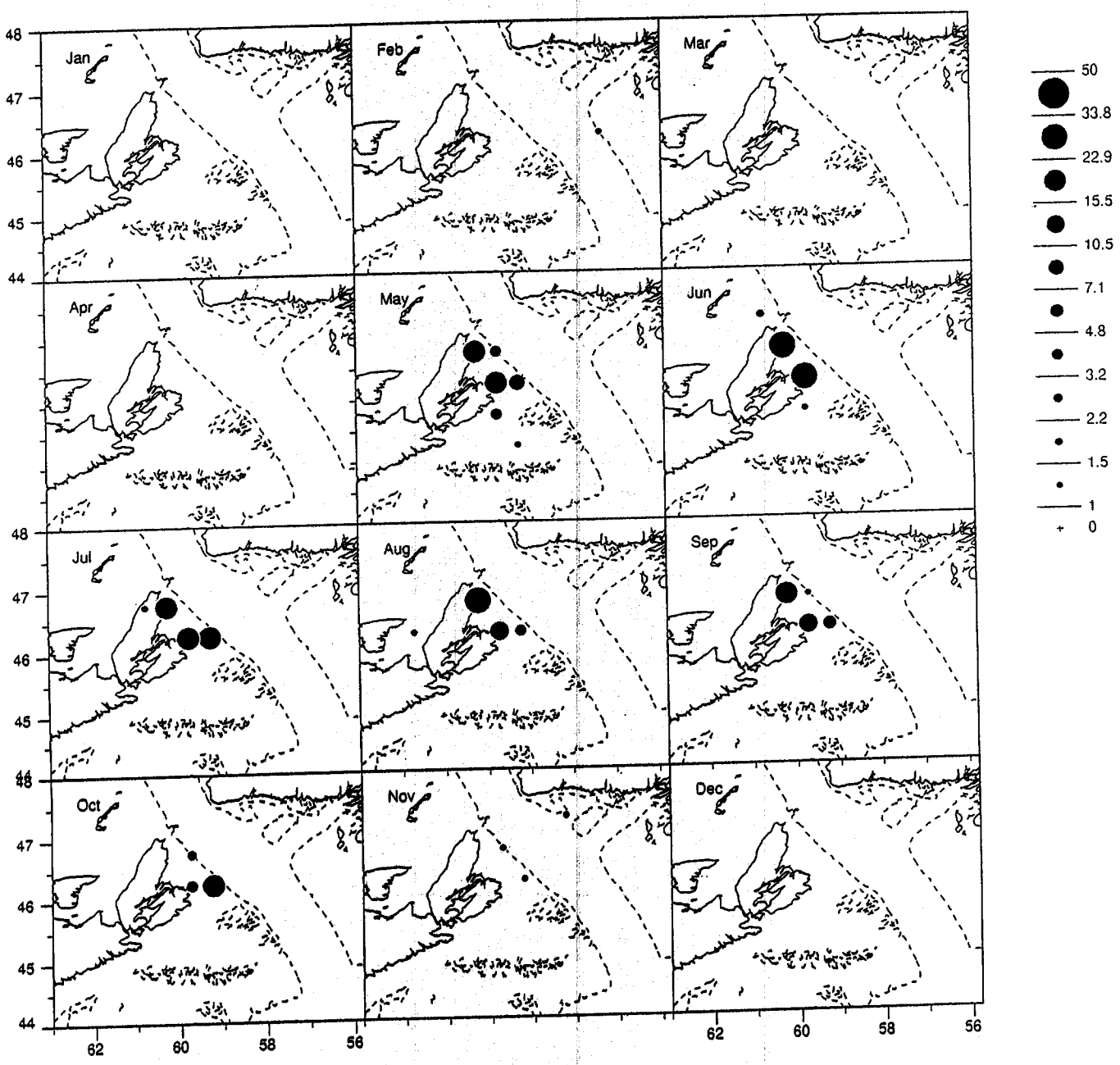


Figure 9. Combined 1997-99 recoveries of tagged American plaice released in Sydney Bight. Recoveries are aggregated over 5 minute squares.

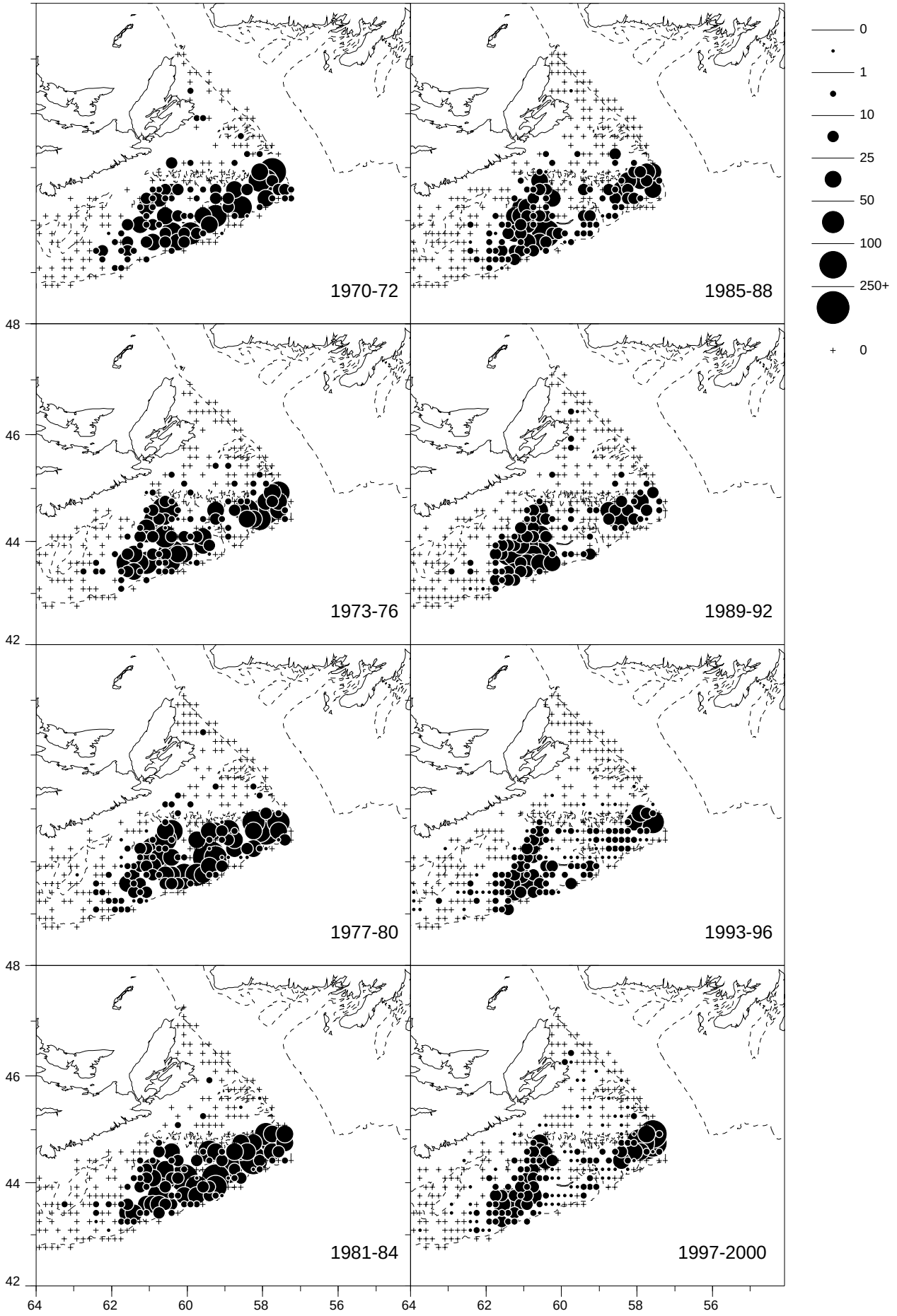


Figure 10. Yellowtail flounder distributions (catch in kgs) from summer research vessel surveys. The catches are averaged over years within 10 minute squares.

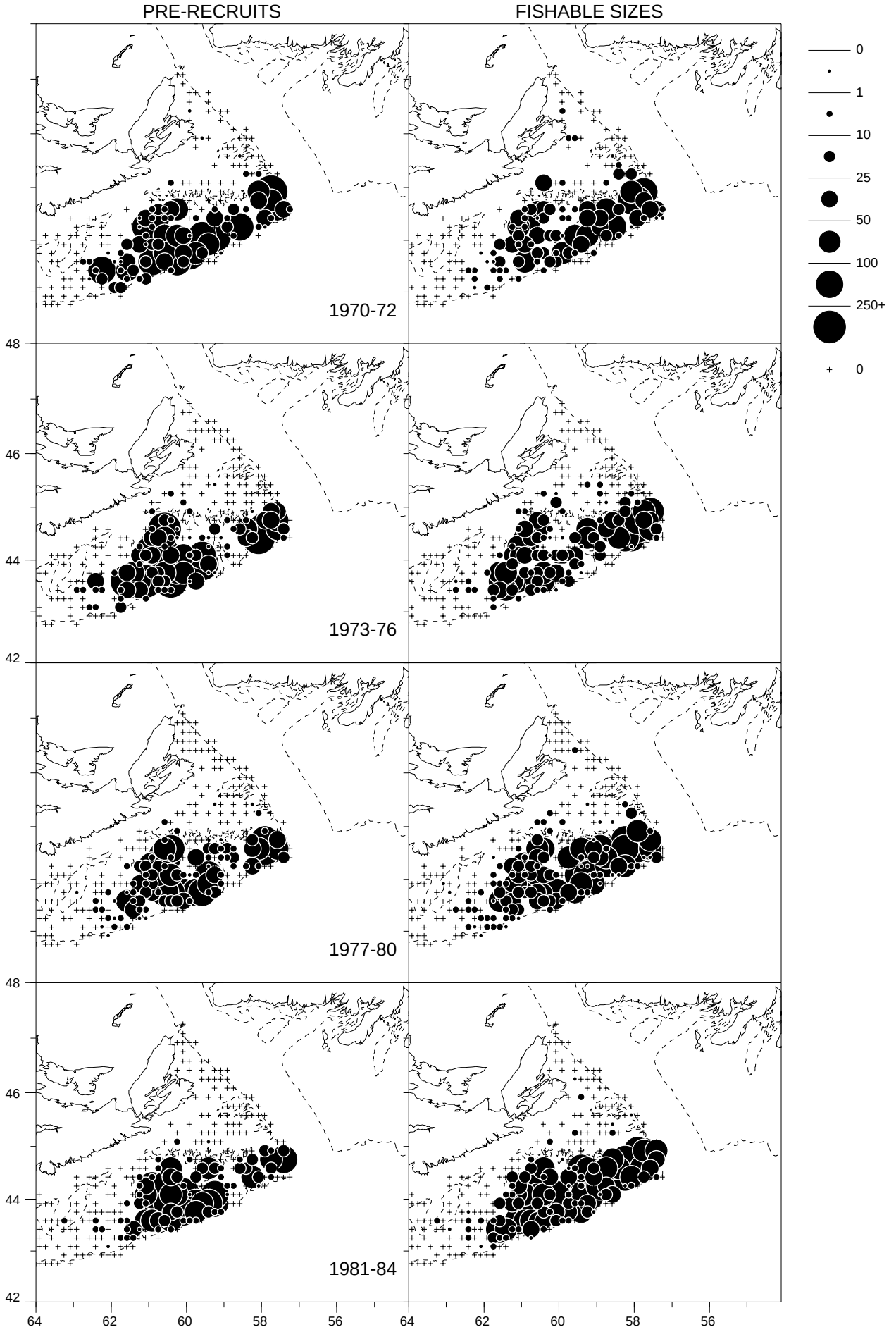


Figure 11 a). Distributions, in total numbers, of pre-recruited (30cm or smaller) and fishery-sized yellowtail flounder from summer research vessel surveys. The catches are averaged over years within 10 minute squares.

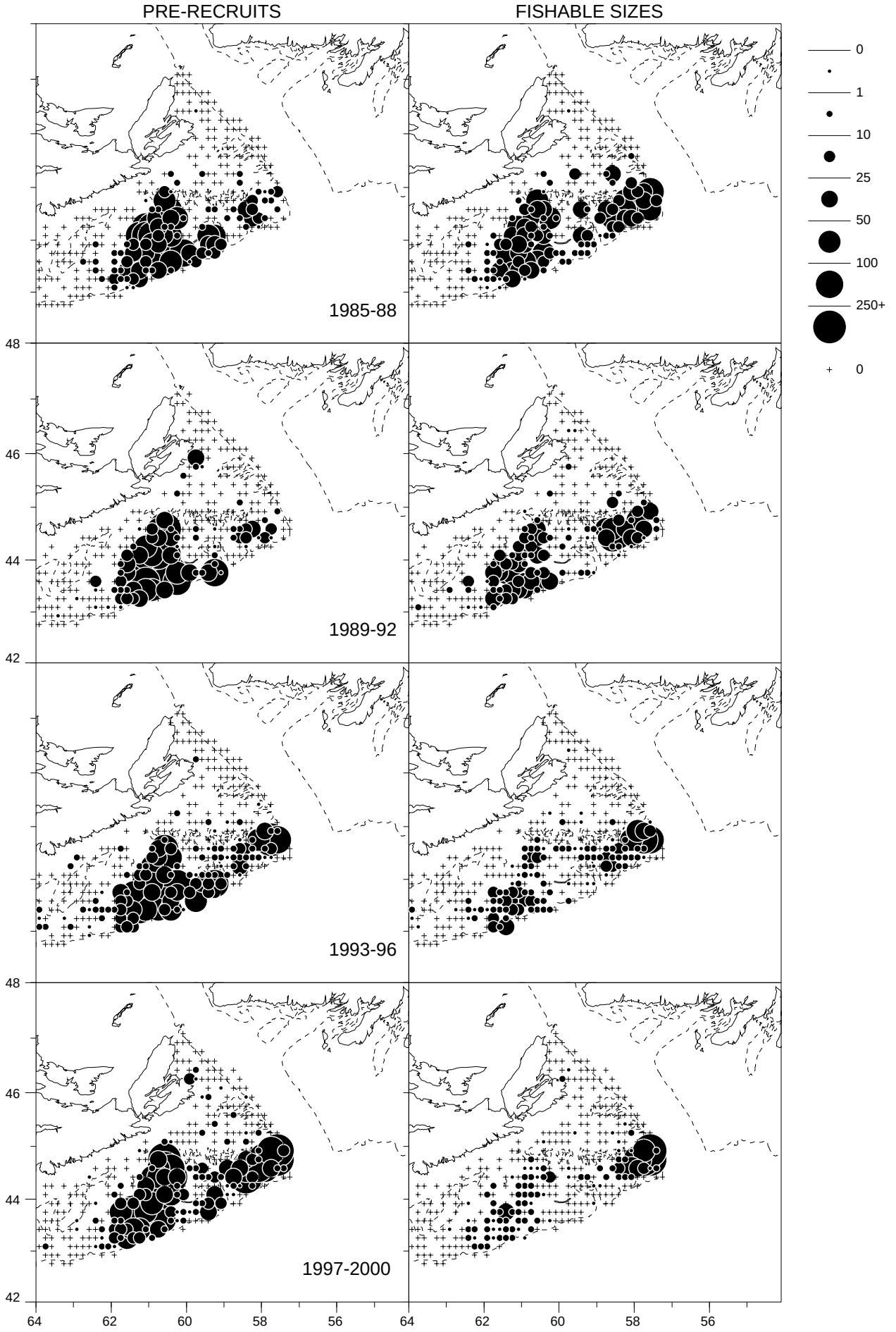


Figure 11 a) (con't).

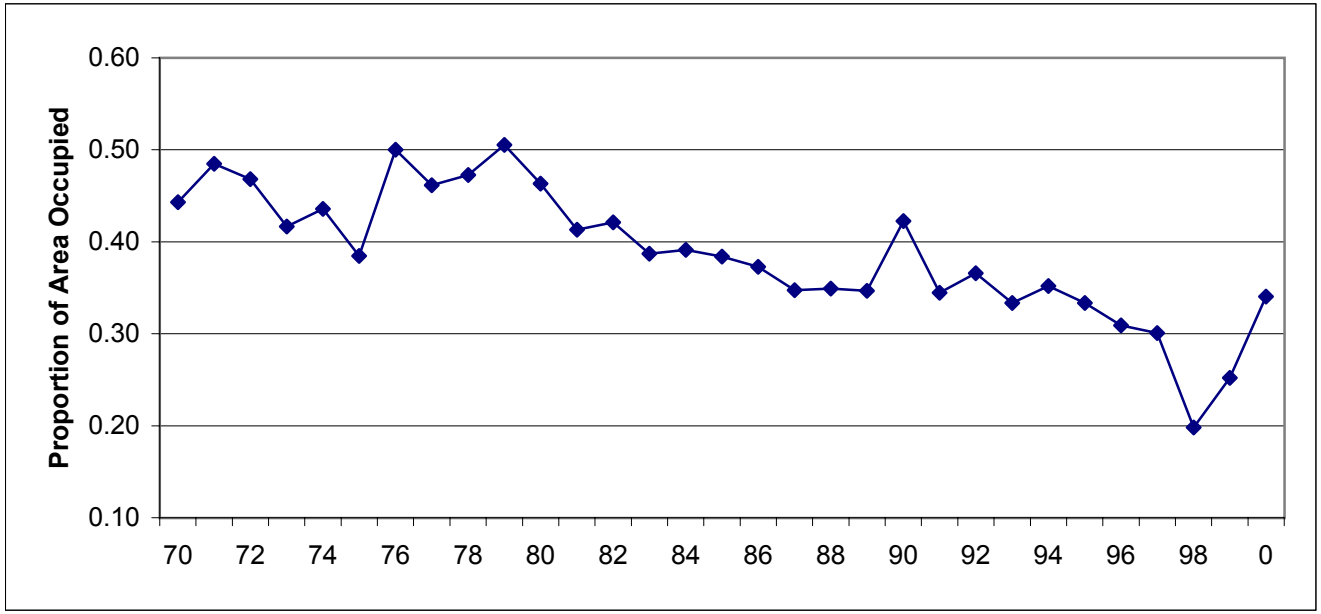


Figure 11 b). Proportion of sets with non-zero catches of fishery-sized yellowtail flounder in the 4VW survey area.

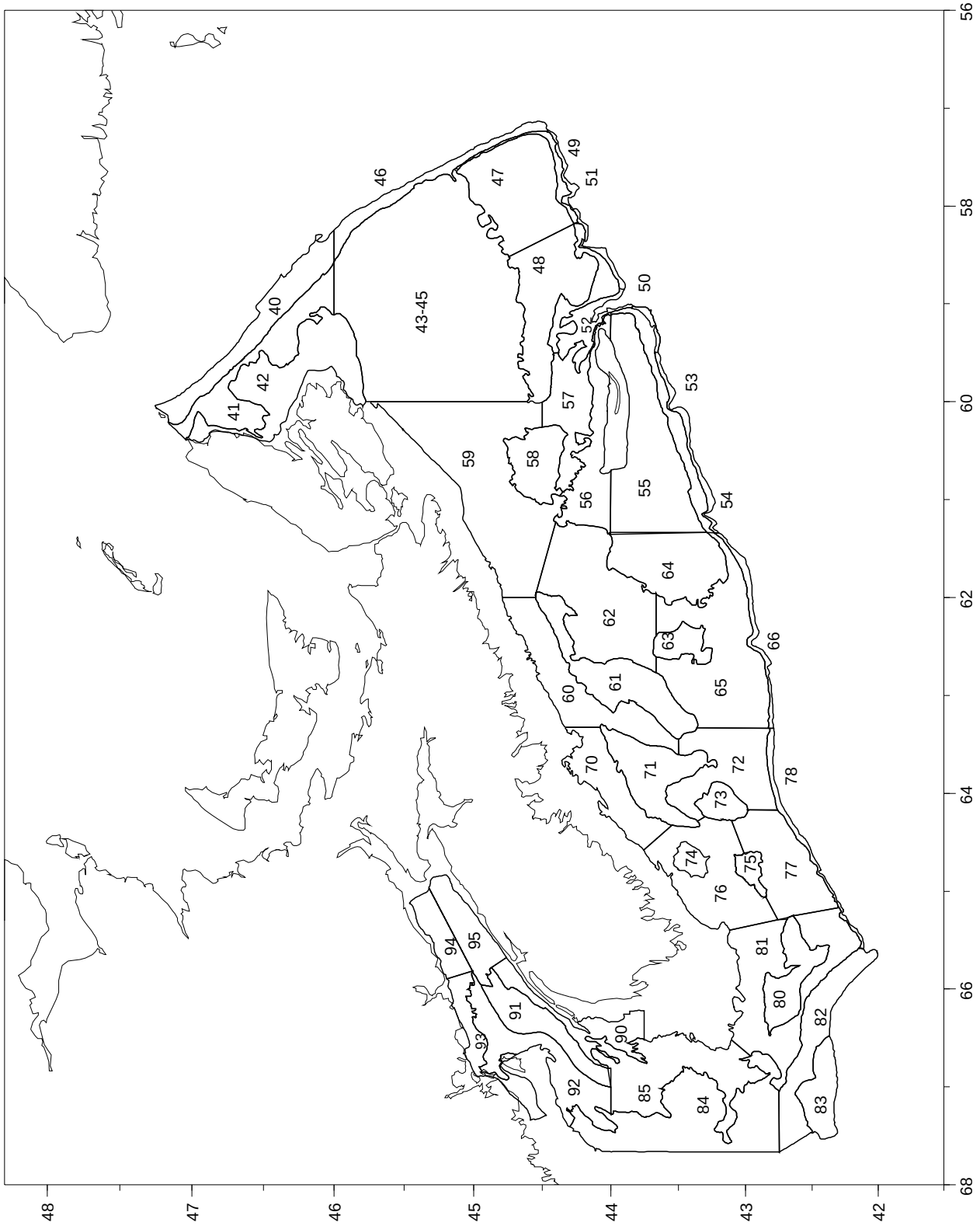


Figure 12. Canadian Research Vessel survey strata referred to in this paper. The 4VW strata are 40-66

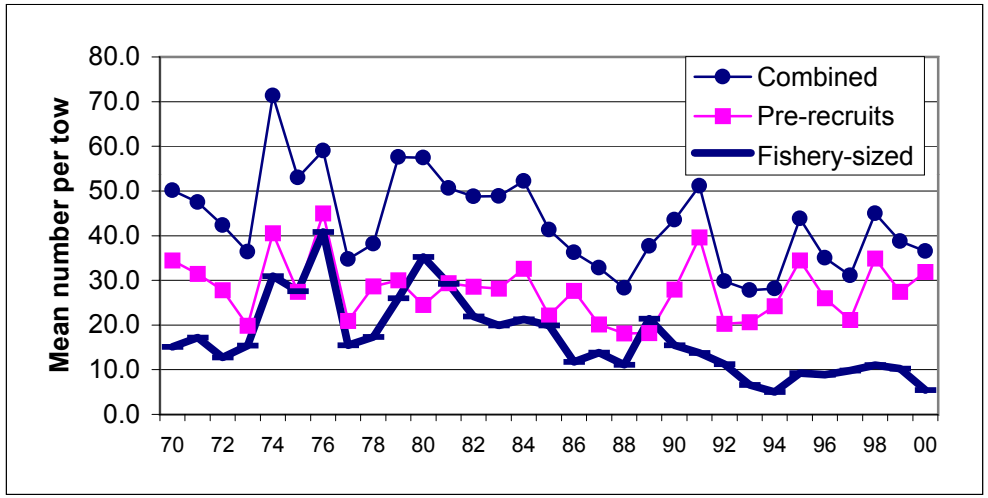


Figure 13 a). Stratified numbers per tow of 4VW American plaice caught during summer Research Vessel surveys. We define fishery size as fish over 30cm.

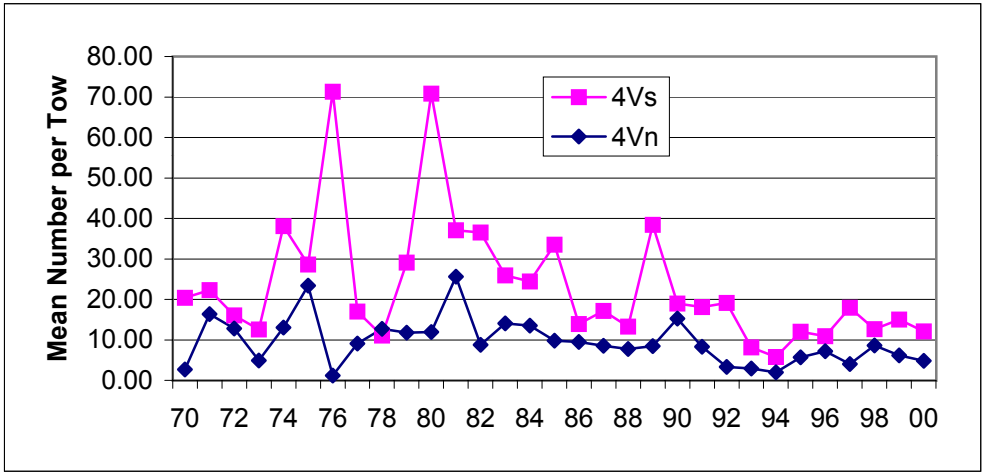


Figure 13 b). Stratified numbers per tow of 4Vs and 4Vn fishery-sized American plaice caught during summer Research Vessel surveys. We define fishery size as fish over 30cm.

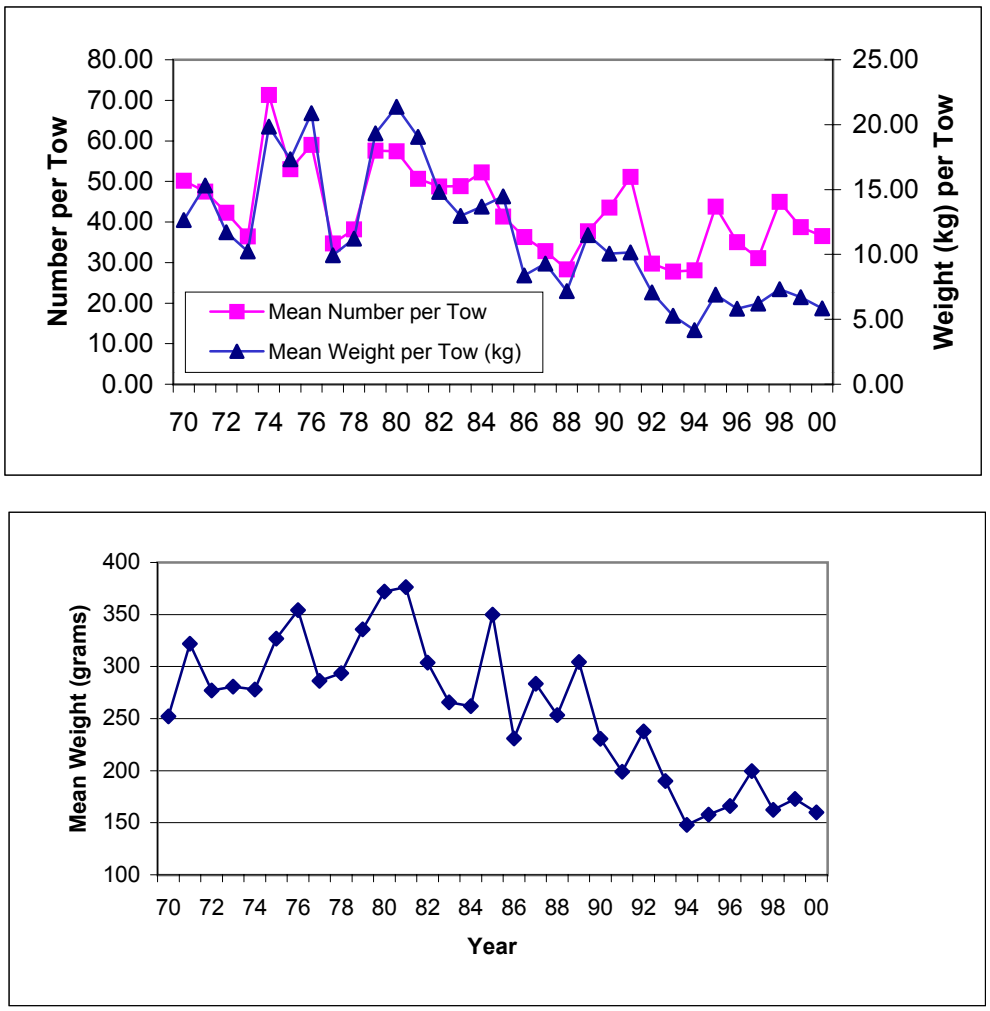


Figure 14. Numbers and weights per tow of 4VW American plaice (upper panel), and stratified mean fish weights (lower panel) over the years from summer Research Vessel surveys.

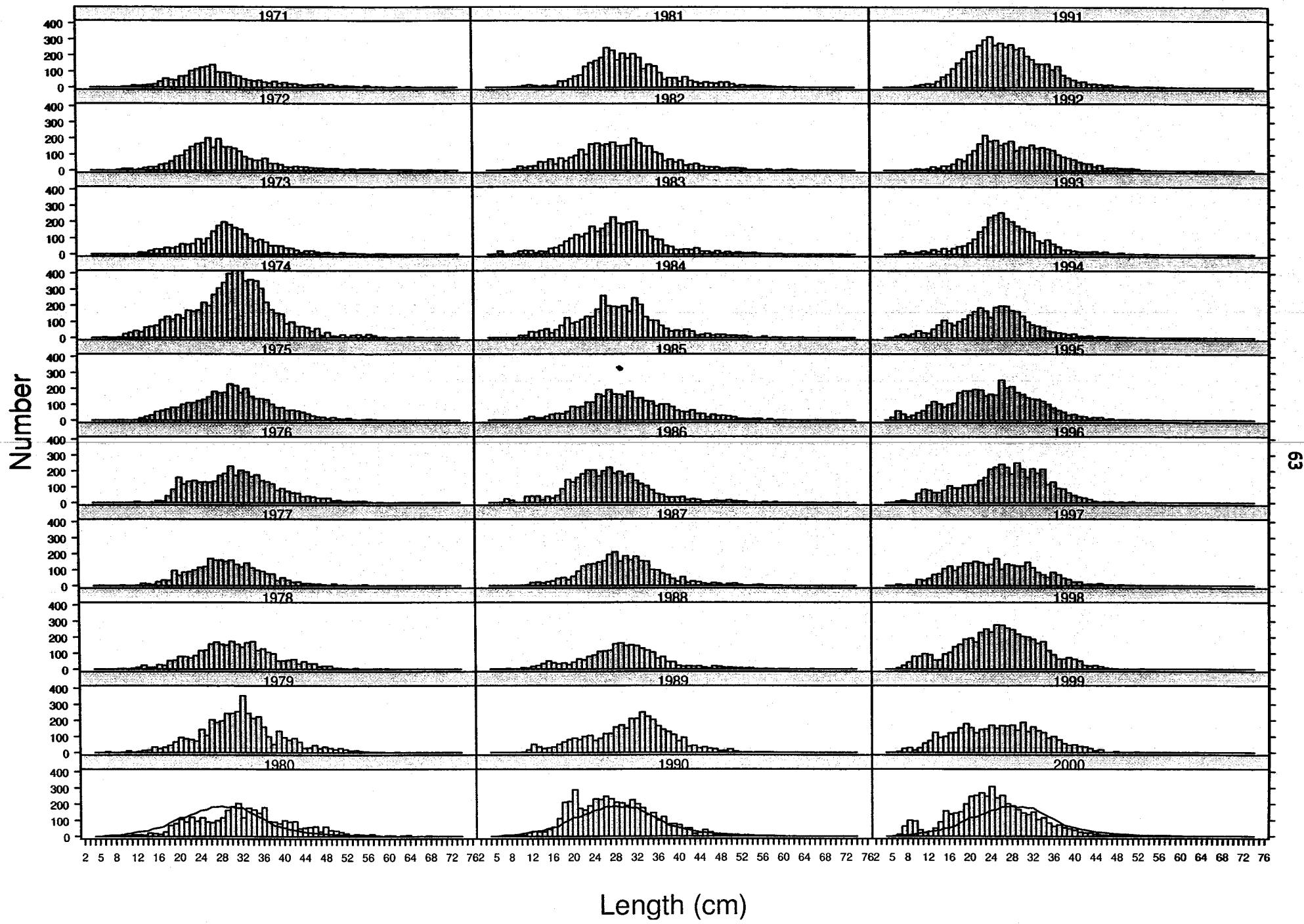


Figure 15. Length frequencies (adjusted to total catch) of 4VW American plaice from 1971-2000 summer research vessel surveys. An overall mean length frequency line is repeated across the bottom graphs.

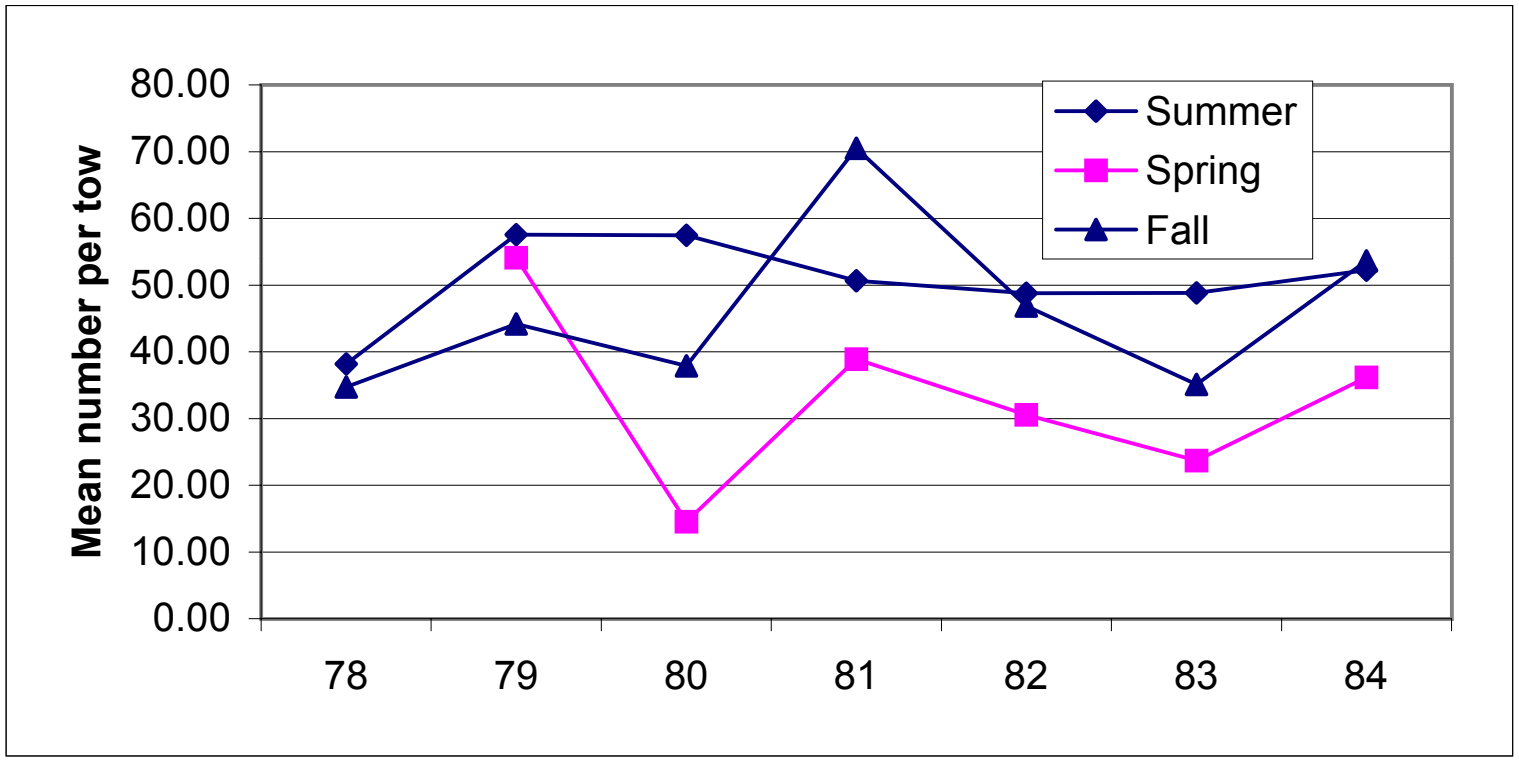


Figure 16. Stratified numbers per tow of 4VW American plaice caught during spring, summer and fall Research Vessel surveys between 1978 and 1984.

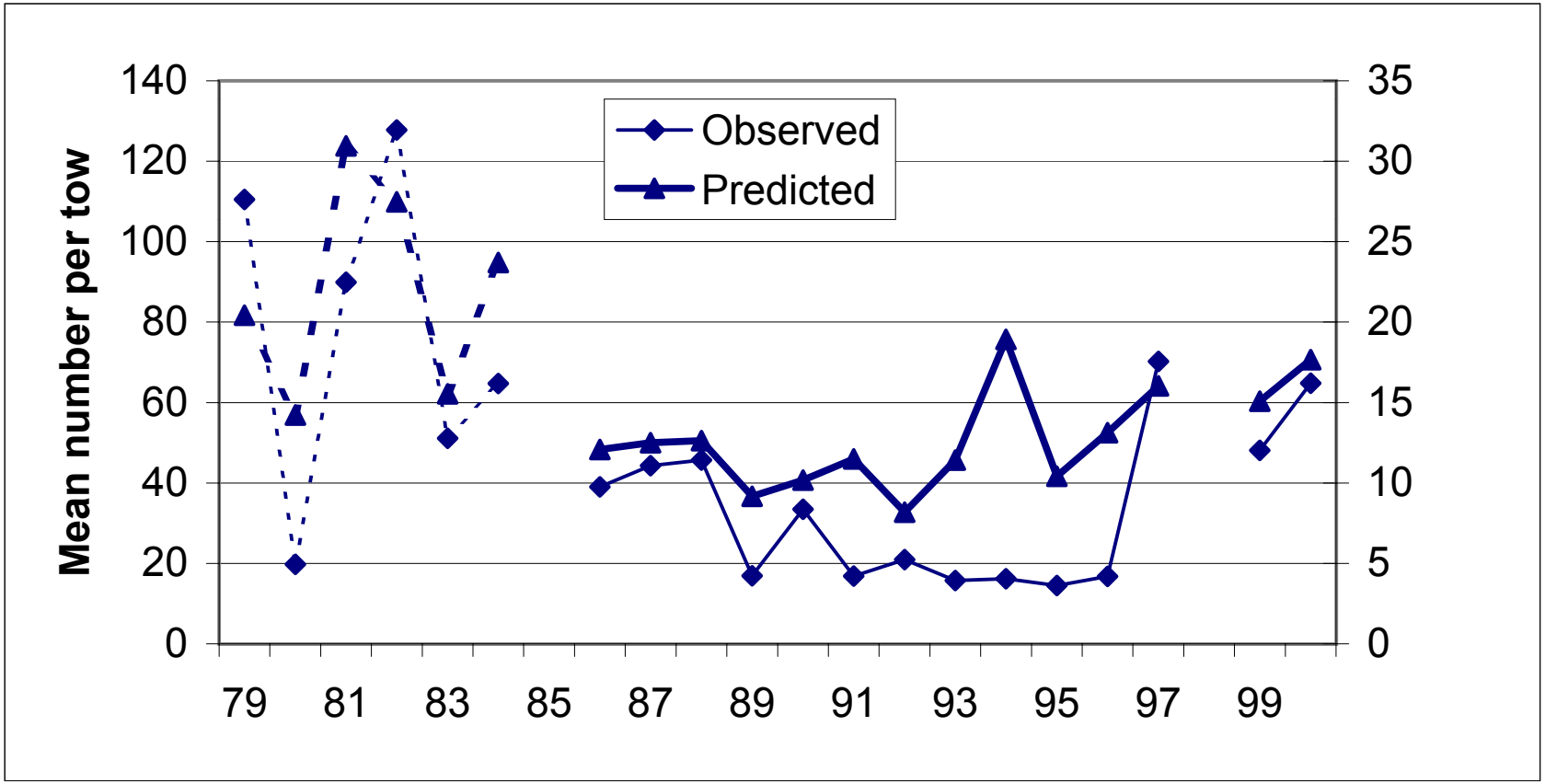


Figure 17. Mean numbers per tow of 4VsW American plaice observed and predicted during Spring Research Vessel surveys between 1979 and 1999. Solid lines represent the March 4VsW Cod survey. The prediction is for depth=225m, 1st week of March, 3.5^{0} C.

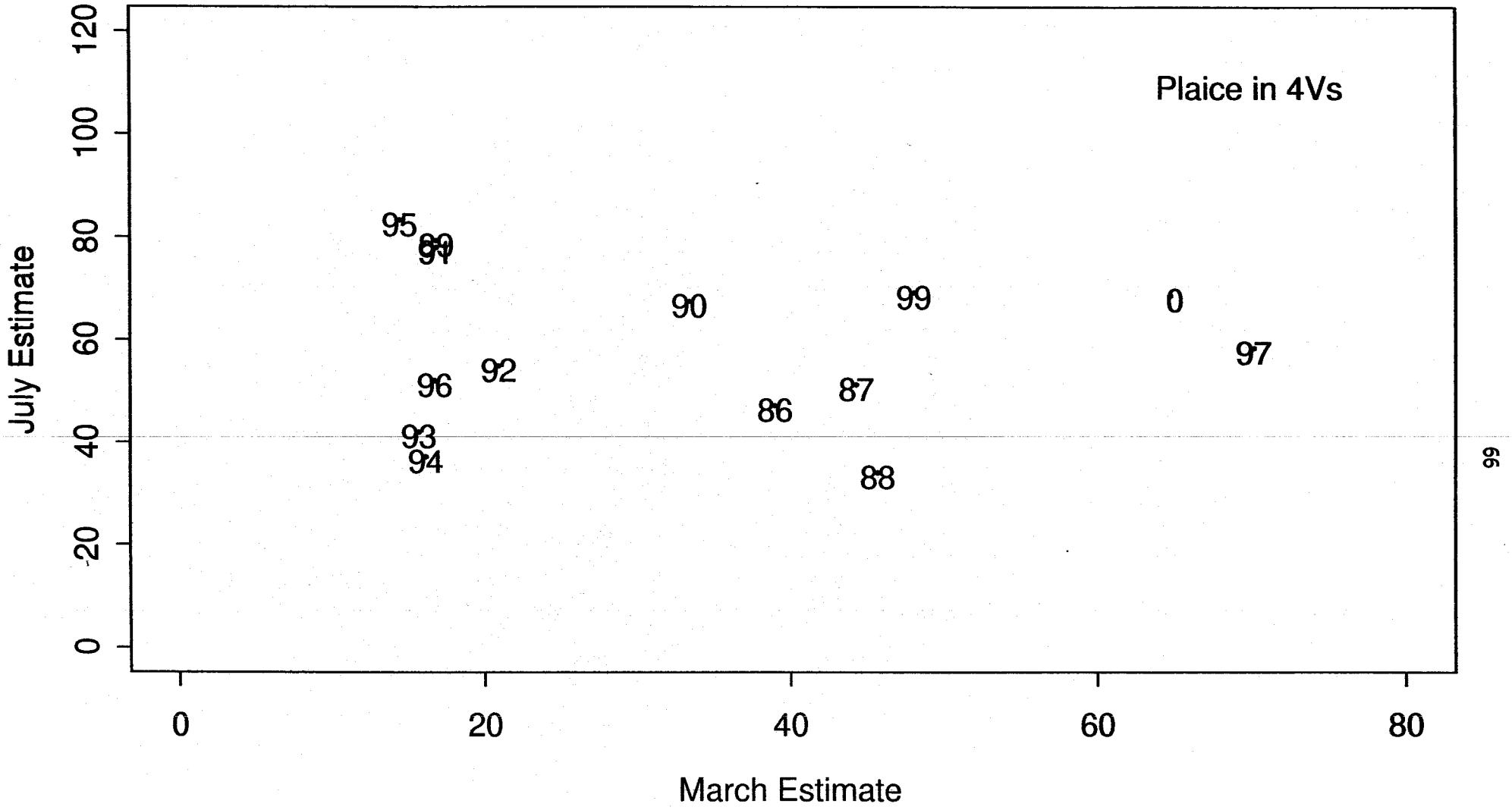


Figure 18. Scatterplot of March versus July Research Vessel number per tow of American plaice in 4Vs.

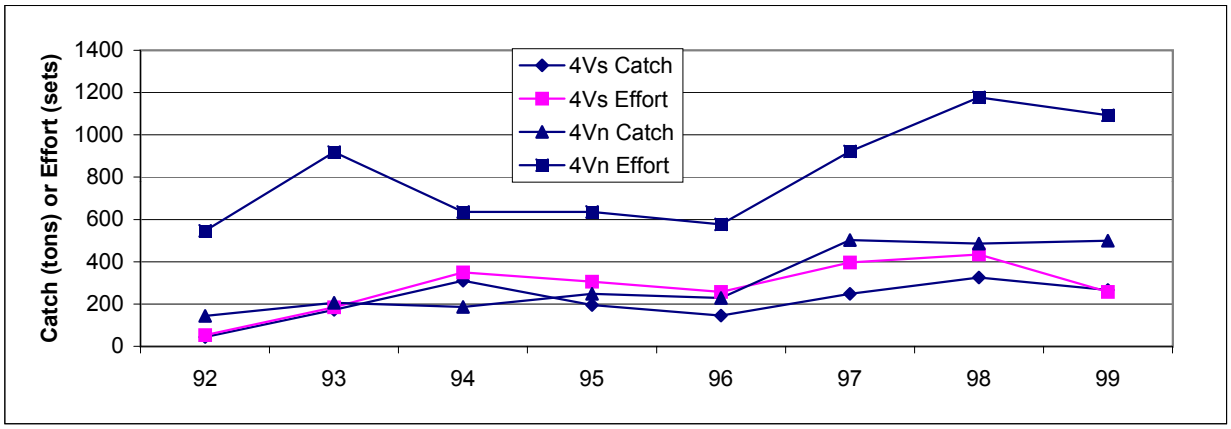


Figure 19(a). Directed catch (mt) of American plaice and associated effort (sets) by index Danish seiners in 4Vs and 4Vn.

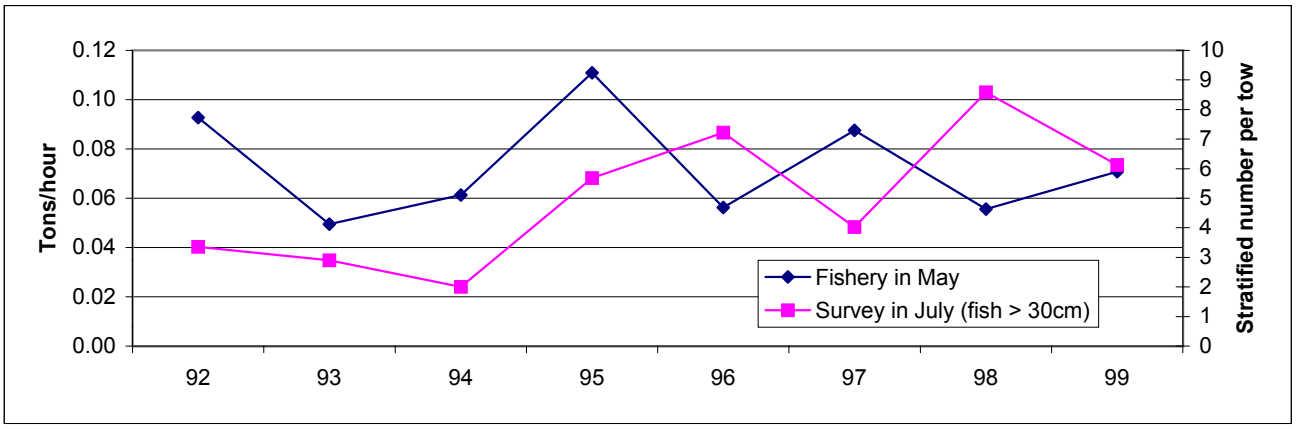


Figure 19(b). Sydney Bight (4Vn) American plaice catch per unit effort of Danish seiners worked by dedicated fishers (directing for plaice in all years) in May, as well as the stratified number per tow from the July Research Vessel survey.

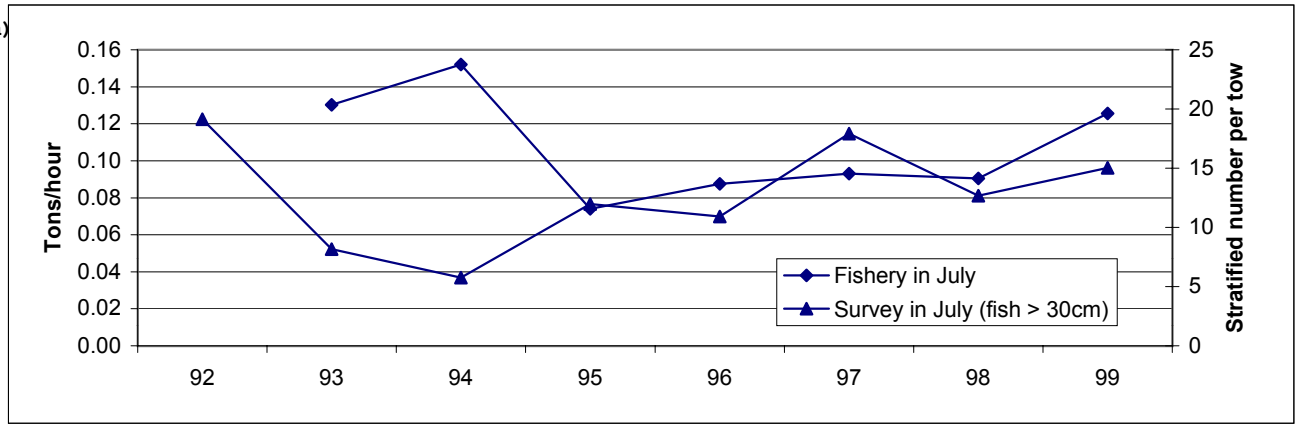


Figure 19(c). Banquereau (4Vs) American plaice catch per unit effort of Danish seiners worked by dedicated fishers (directing for plaice in all years) in July, as well as stratified number per tow from the July Research Vessel survey.

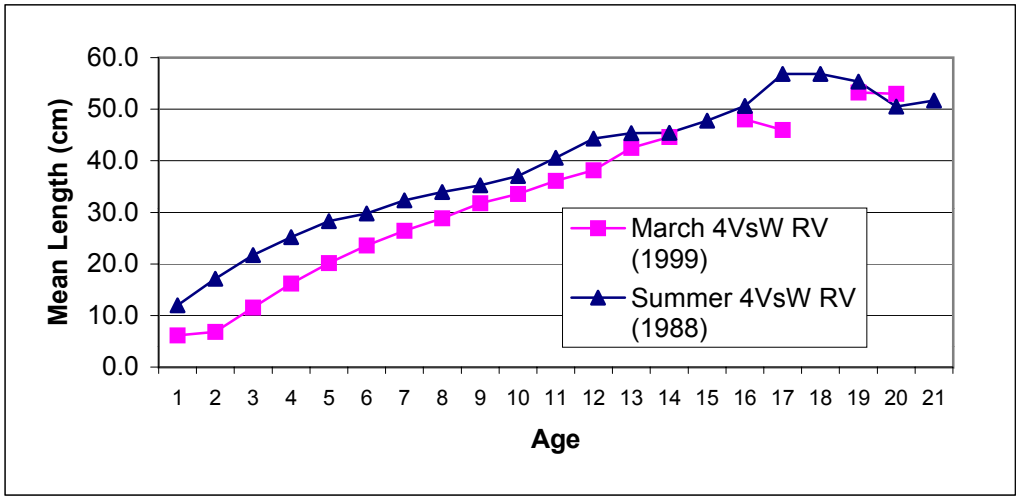


Figure 20(a). Comparison of mean length at age of American plaice between 1988 and 1999.

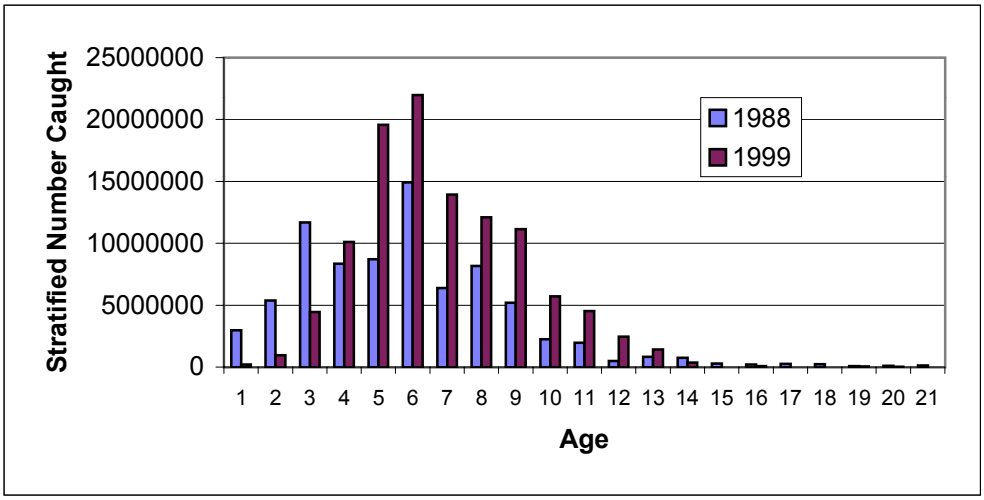


Figure 20(b). Comparison of age distributions of American plaice summer RV surveys between 1988 and 1999.

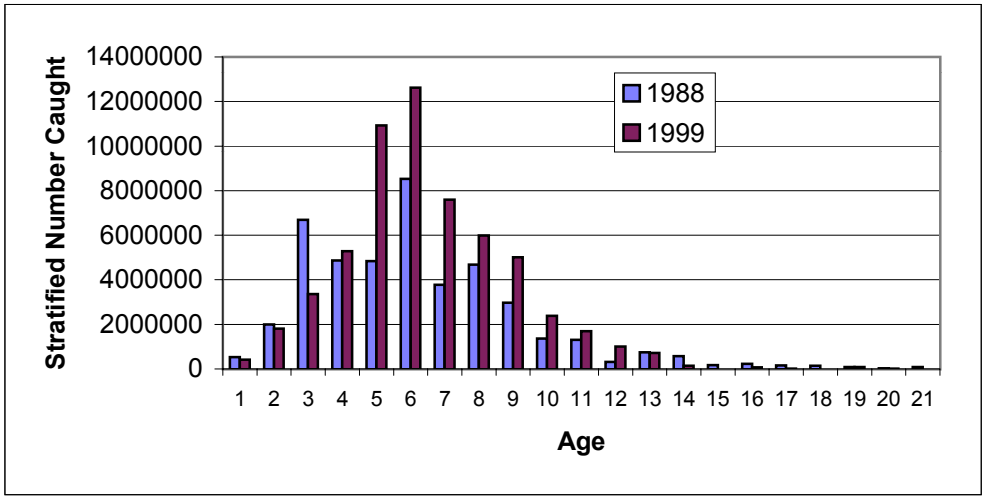


Figure 20(c). Comparison of age distributions of American plaice 4VsW March RV surveys between 1988 and 1999.

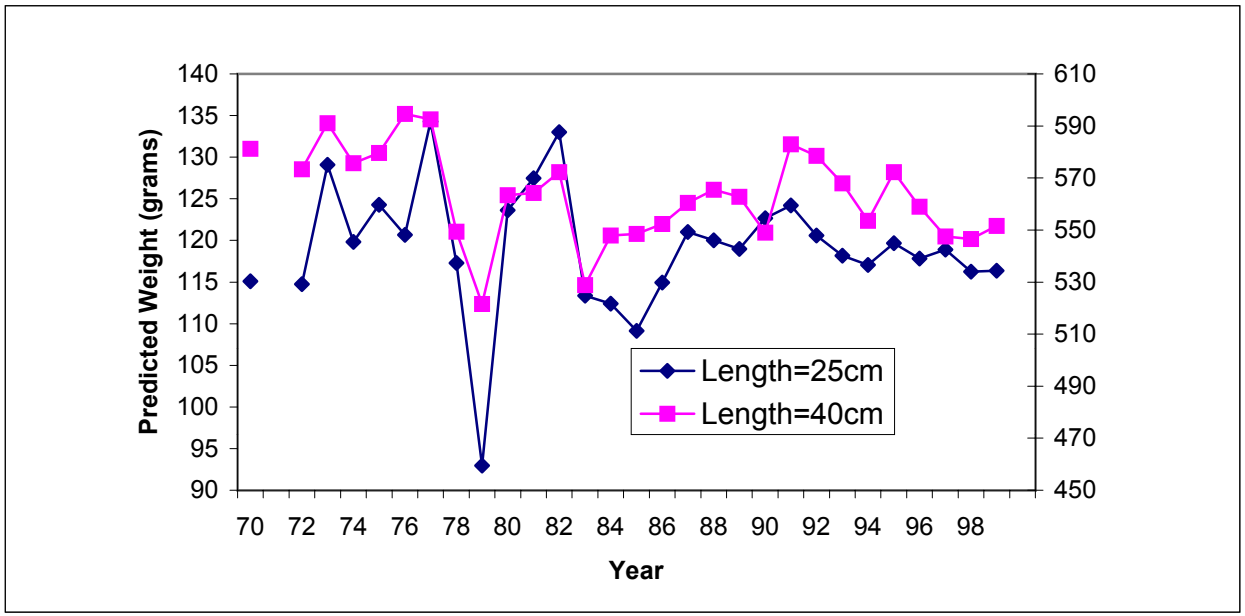


Figure 21. Weight at length for immature (25cm) and mature (40cm) 4VW American plaice over the years from summer Research Vessel surveys. Only predictions based on over 100 fish are shown.

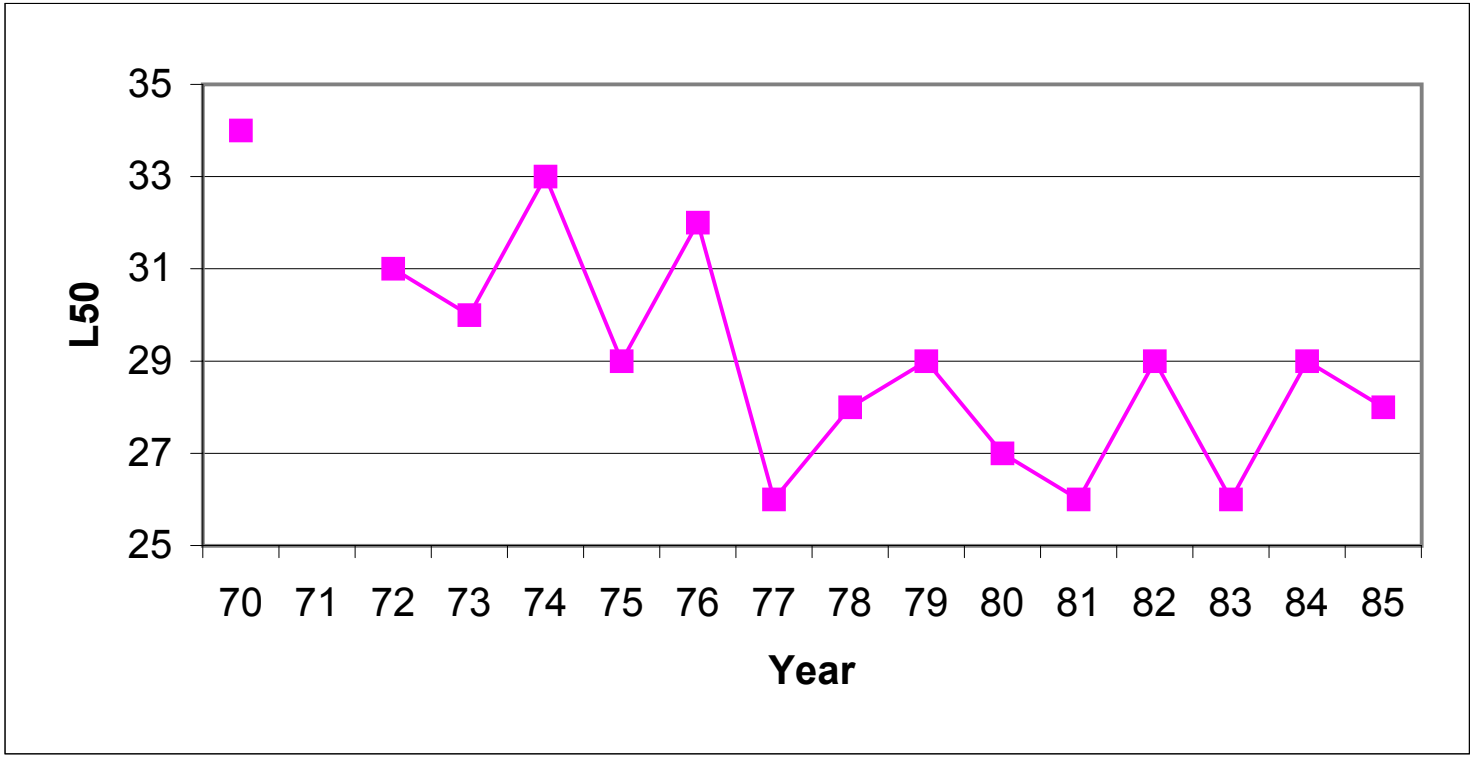


Figure 22. Length at 50% maturity for American plaice females sampled by summer RV surveys in 4VW. A minimum of 10 fish per length was required for inclusion (very little data post-1985).

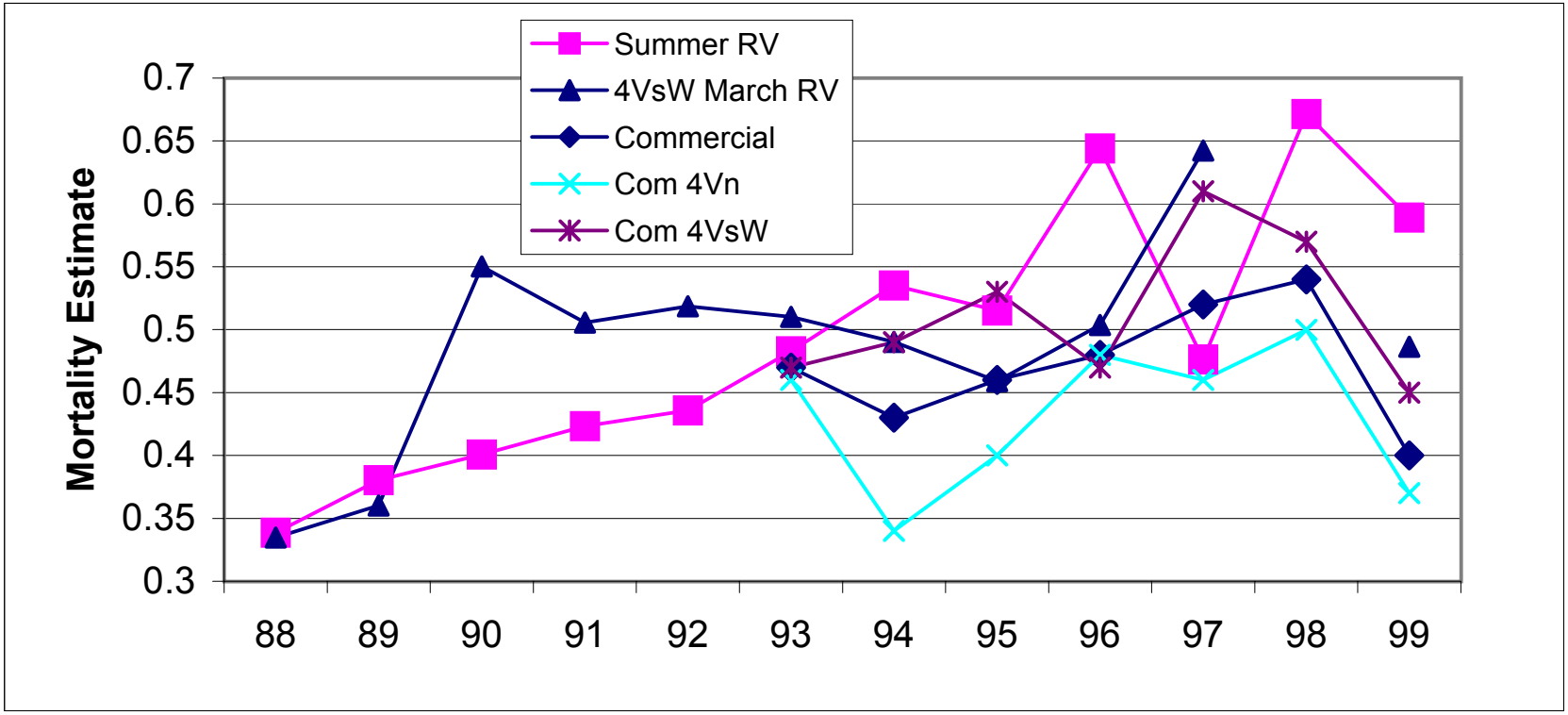


Figure 23(a). Mortality estimates for American plaice from commercial sampling and Research Vessel surveys, based on interpolated age:length keys between 1988 and 1999.

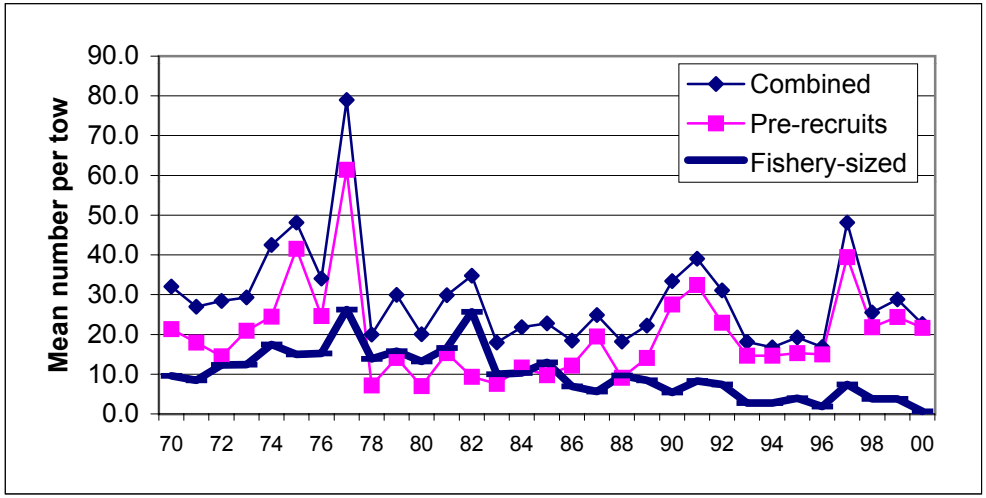


Figure 24 a). Stratified numbers per tow of 4VW yellowtail flounder caught during summer Research Vessel surveys. We define fishery size as fish over 30cm.

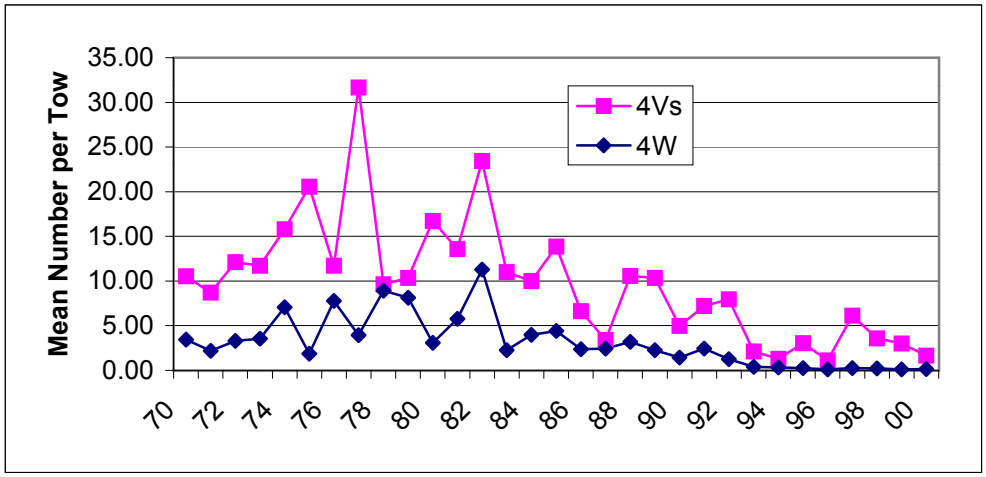


Figure 24 b). Stratified numbers per tow of 4Vs and 4W fishery-sized yellowtail flounder caught during summer Research Vessel surveys. We define fishery size as fish over 30cm.

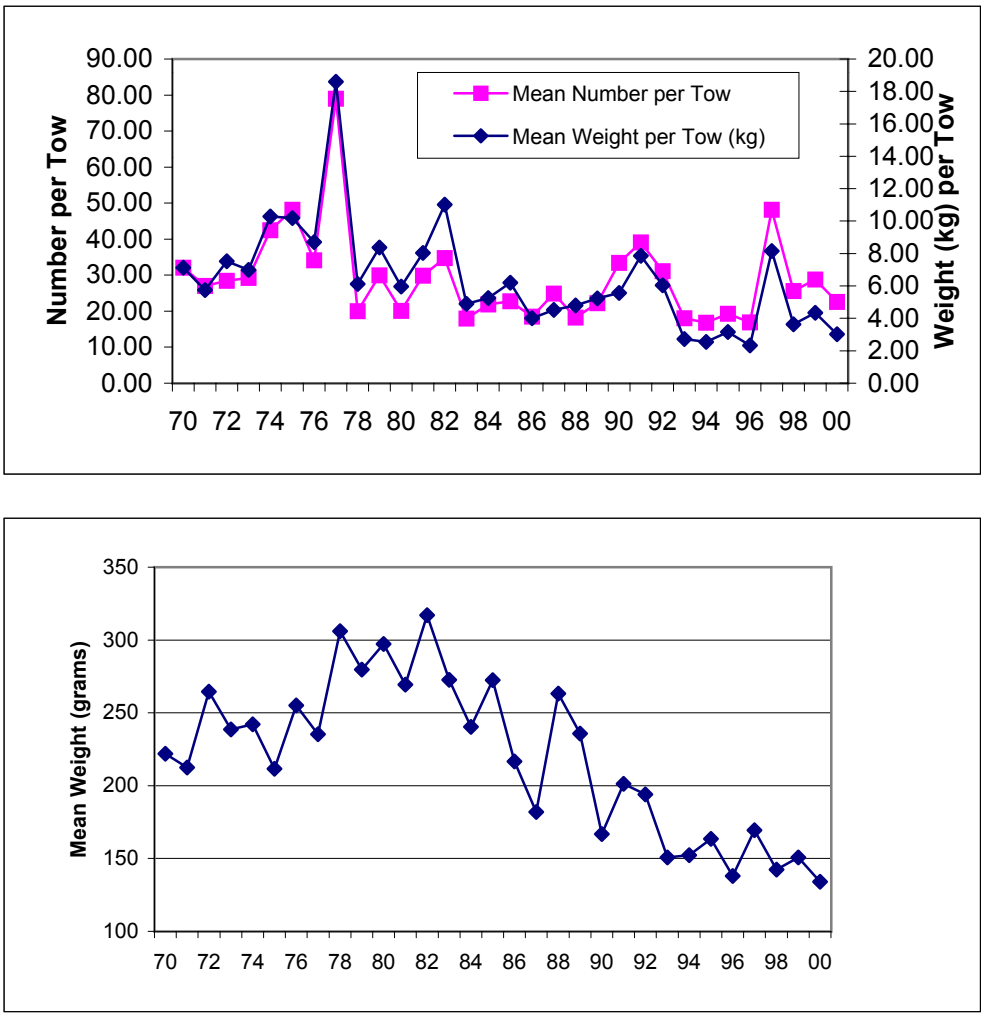


Figure 25. Numbers and weights per tow of 4VW yellowtail flounder, and stratified mean fish weights over the years from summer Research Vessel surveys.

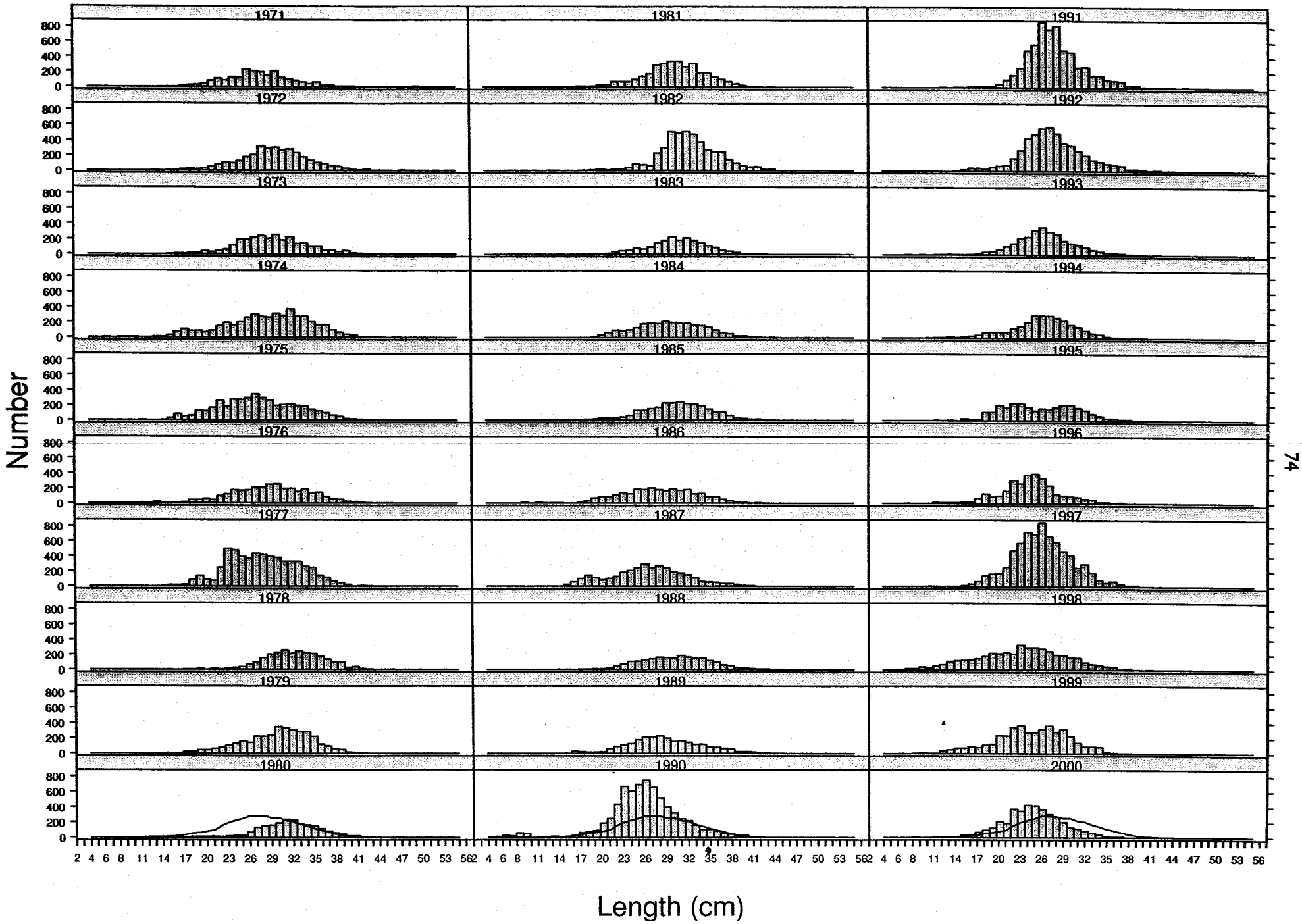
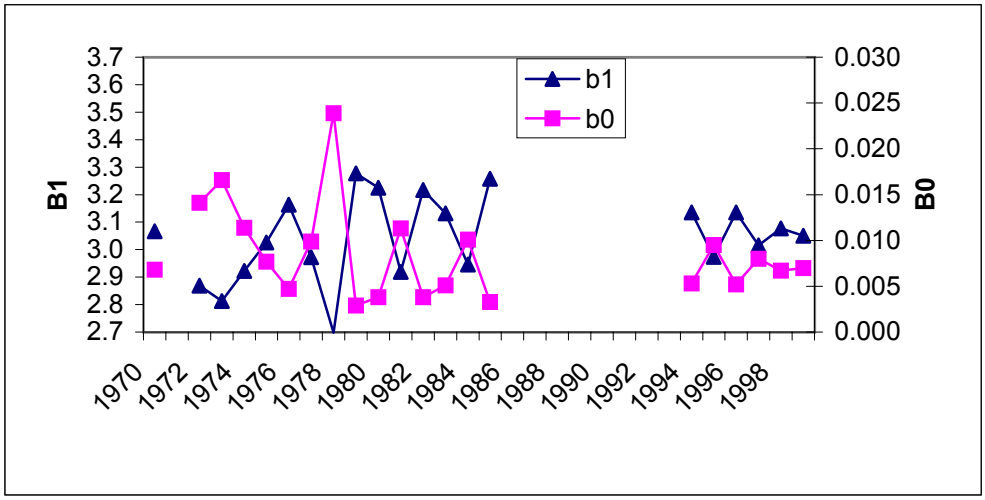


Figure 26. Length frequencies (adjusted to total catch) of 4VW yellowtail flounder from 1971-2000 summer research vessel surveys. An overall mean length frequency line is repeated across the bottom graphs.



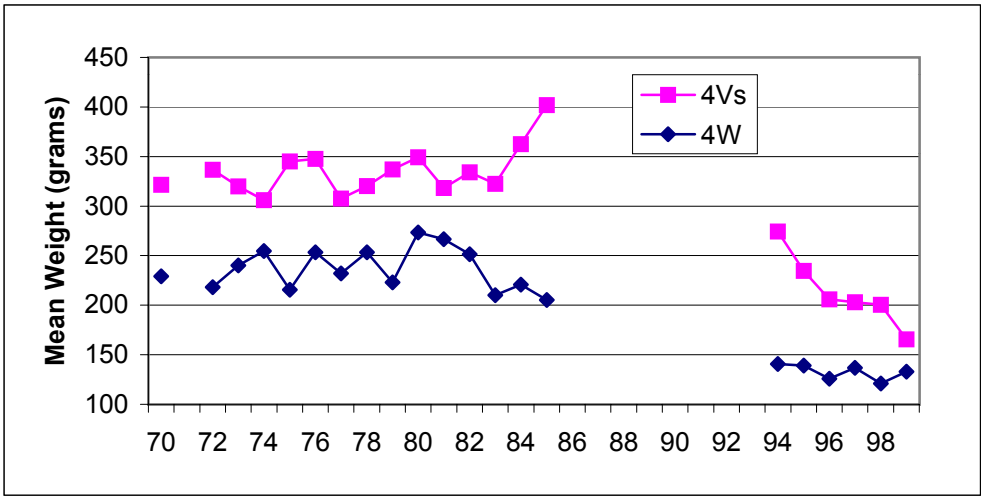


Figure 27. Trends in length:weight equation parameters (the slope B1 and intercept B0) for 4Vs yellowtail flounder, and mean weights for both 4Vs and 4W fish over the years from summer Research Vessel surveys.

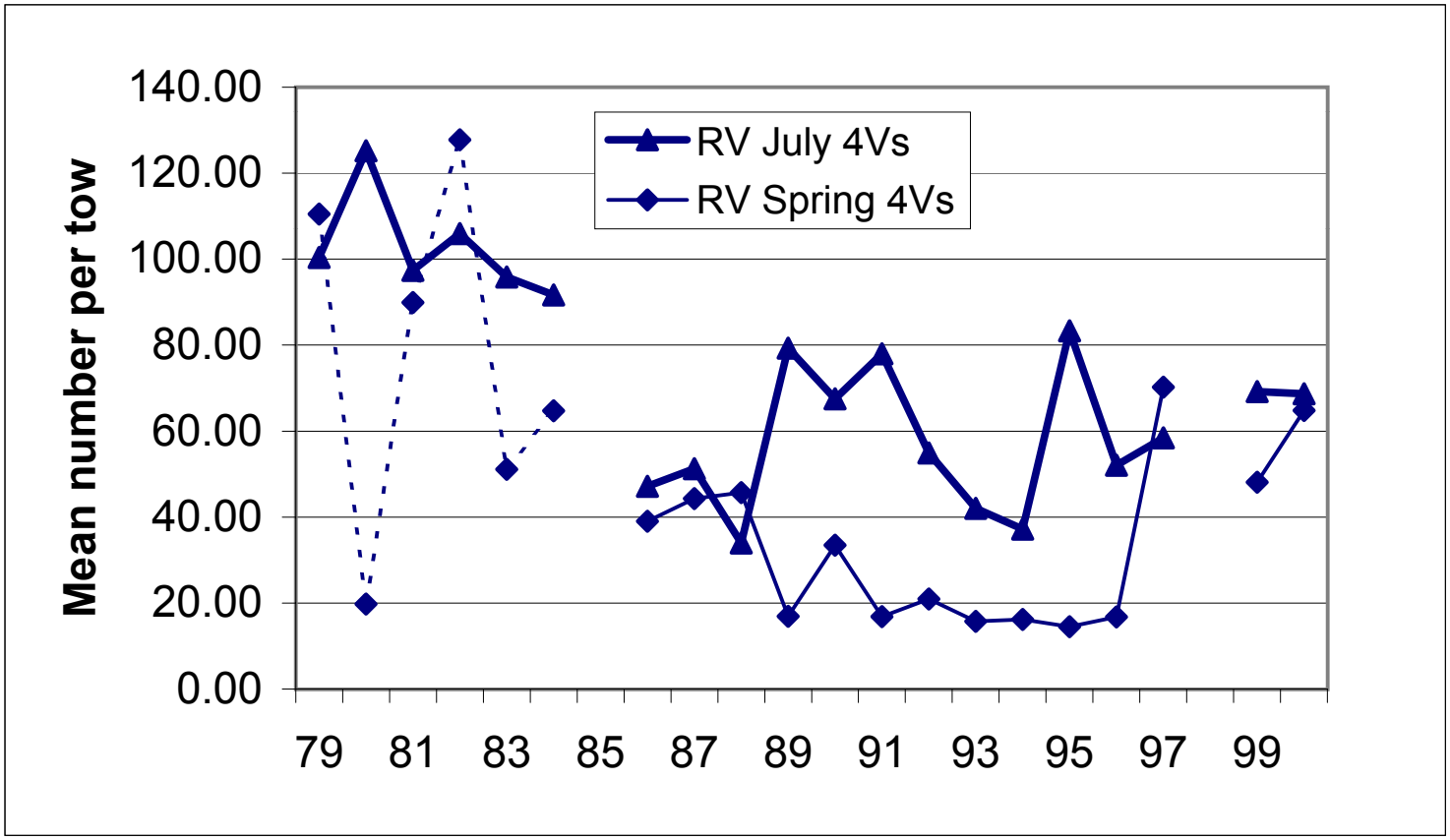
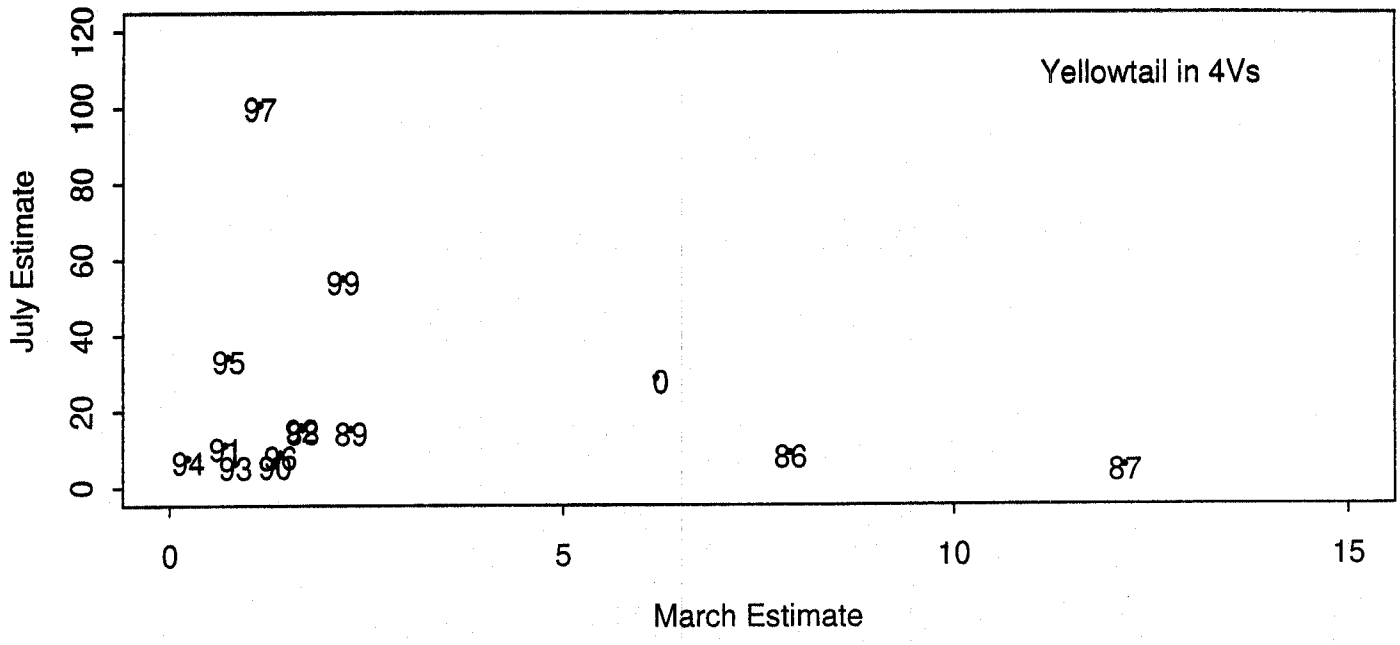


Figure 17. Stratified numbers per tow of 4Vs American plaice caught during Spring and July Research Vessel surveys in coincident years between 1979 and 2000. The solid line for the 1986-2000 spring survey represents the March 4VsW Cod survey.



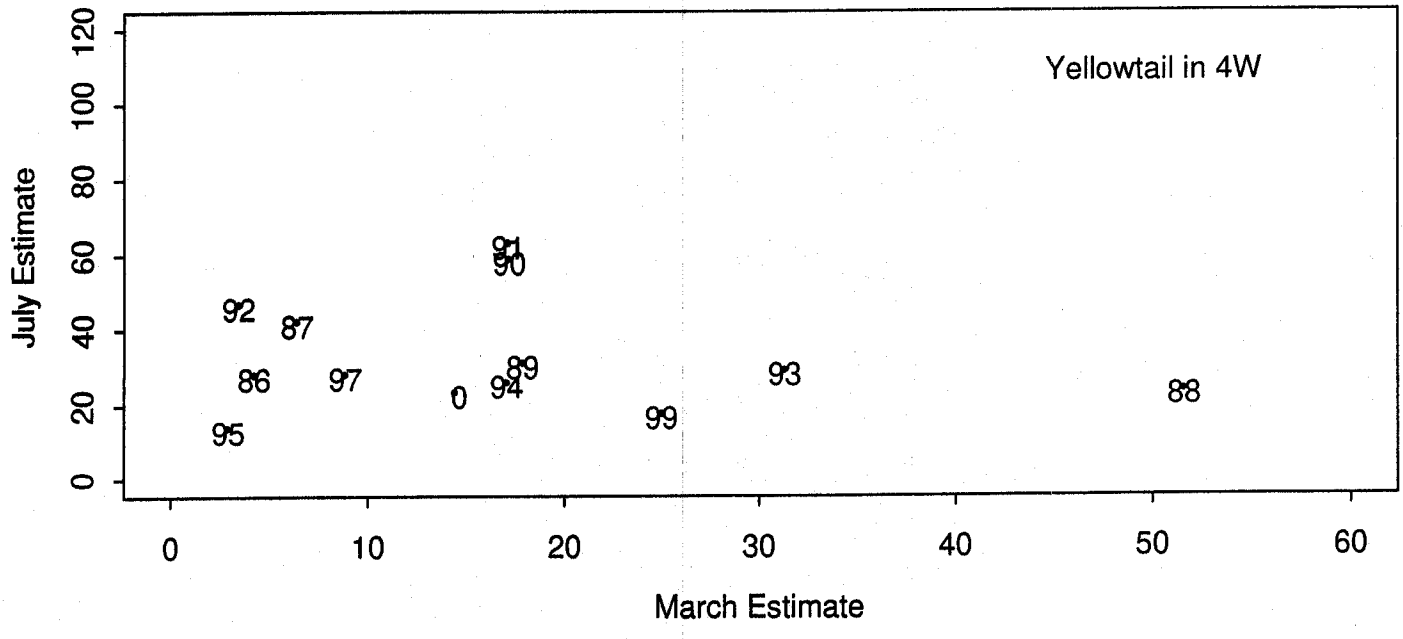


Figure 29. Scatterplots of March versus July Research Vessel number per tow of yellowtail flounder in 4Vs and 4W.

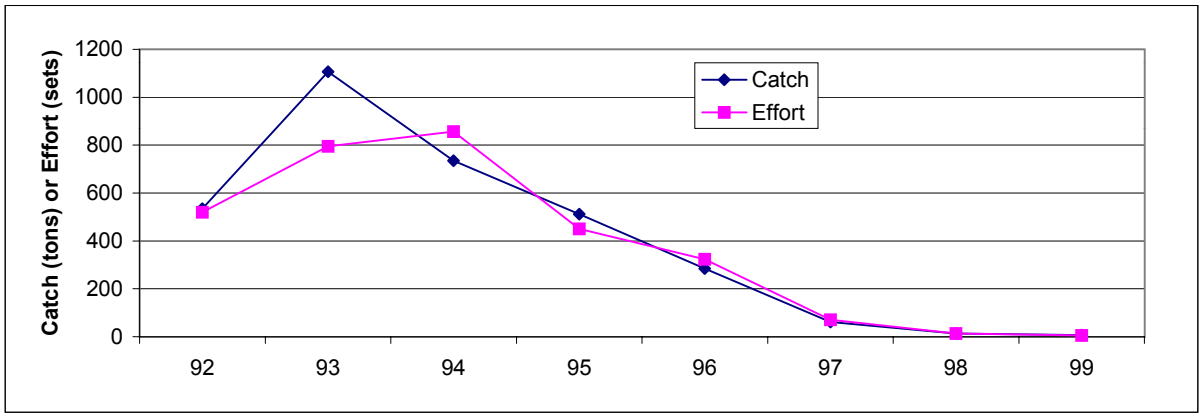


Figure 30(a). 4Vs yellowtail flounder catch (mt) and effort (sets) by index Danish seiners.

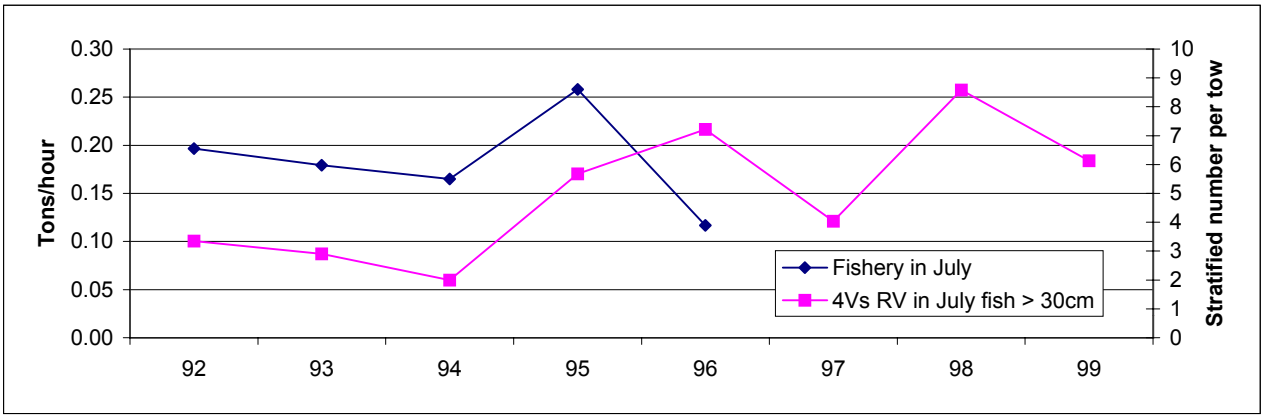


Figure 30(b). Banquereau (4Vs) yellowtail flounder catch per unit effort of Danish seiners worked by dedicated fishers (directing for yellowtail in all years) in July, as well as the stratified number per tow from the July Research Vessel survey.

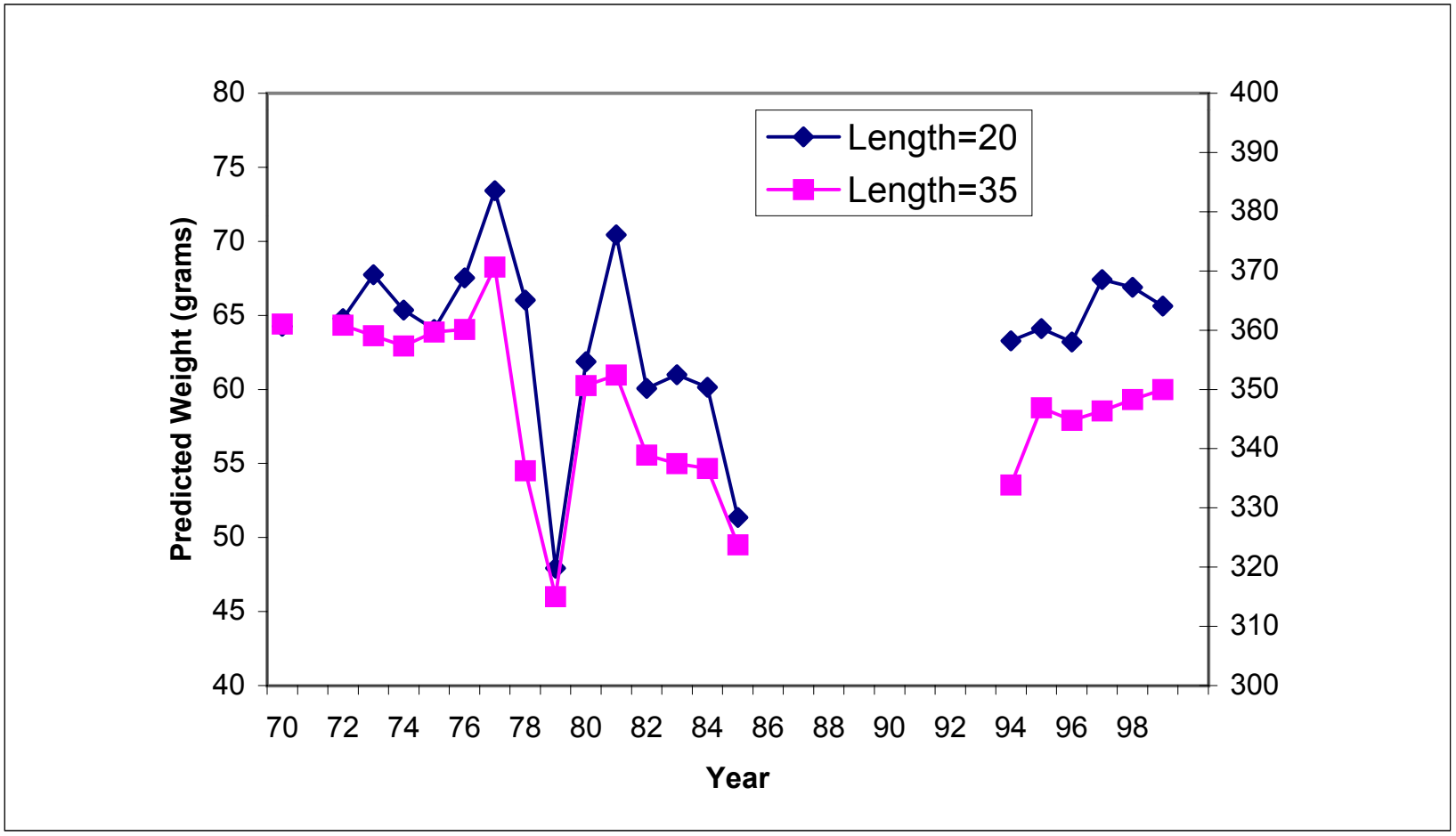


Figure 31. Weight at length for immature (20cm) and mature (35cm) 4VW yellowtail flounder over the years from summer Research Vessel surveys.

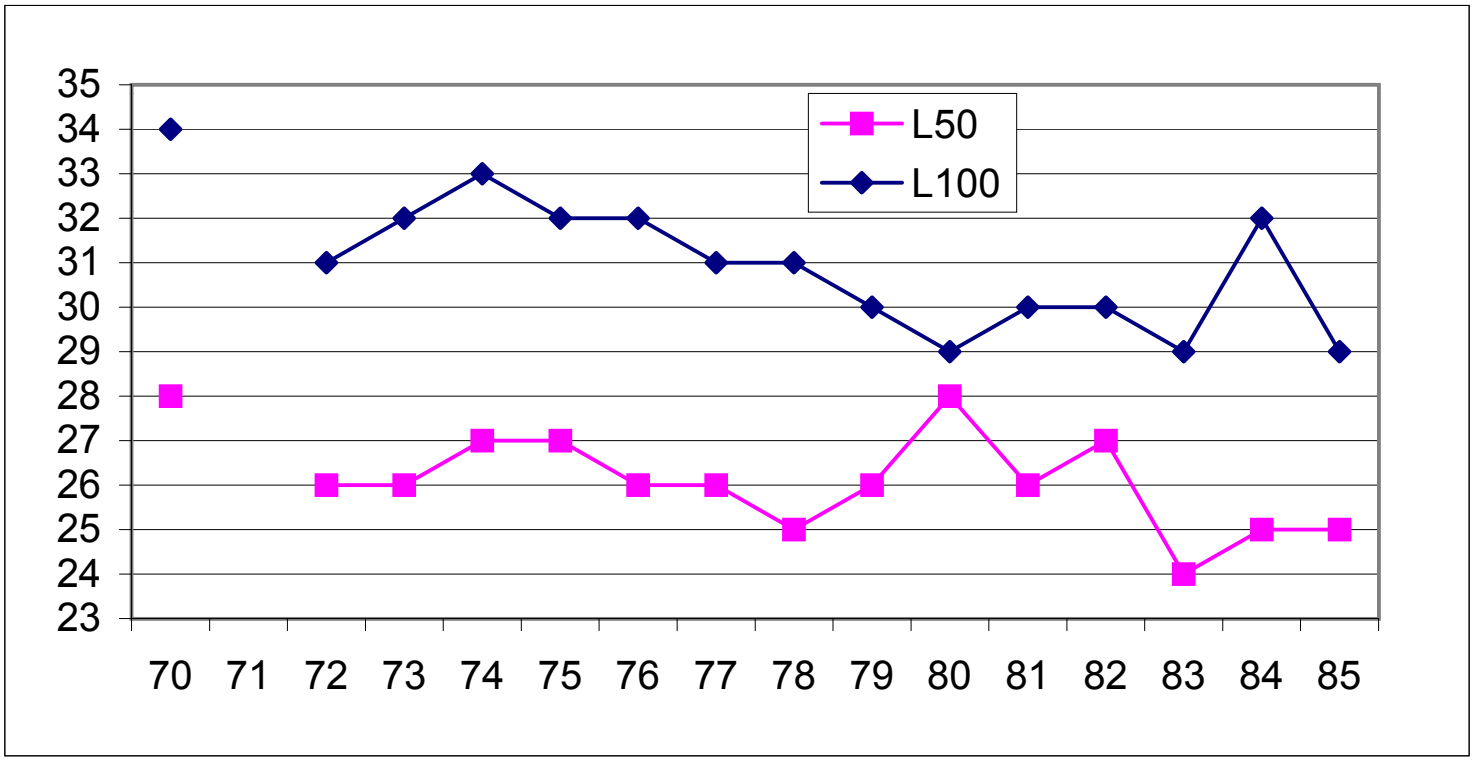


Figure 32. Length at maturity for yellowtail flounder females sampled by summer RV surveys in 4VW. A minimum of 9 fish per length was required for inclusion (very little data post-1985).

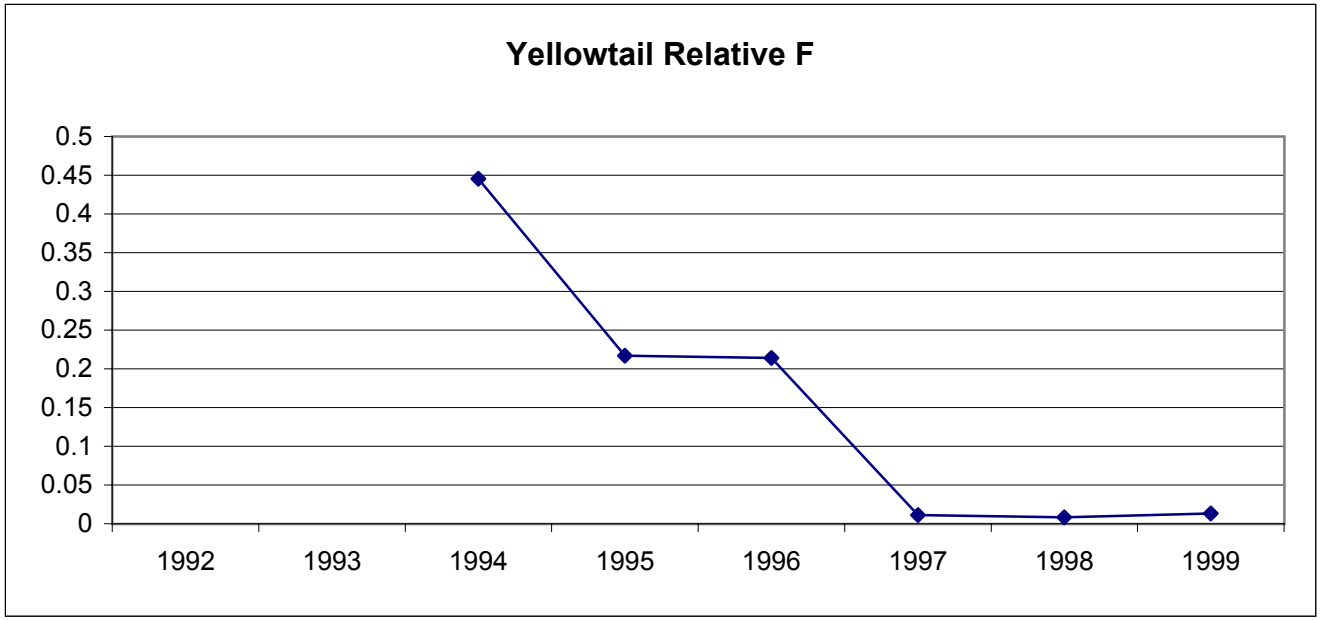


Figure 33. Relative fishing mortality of 4VW yellowtail flounder for the 1994-1999 period.

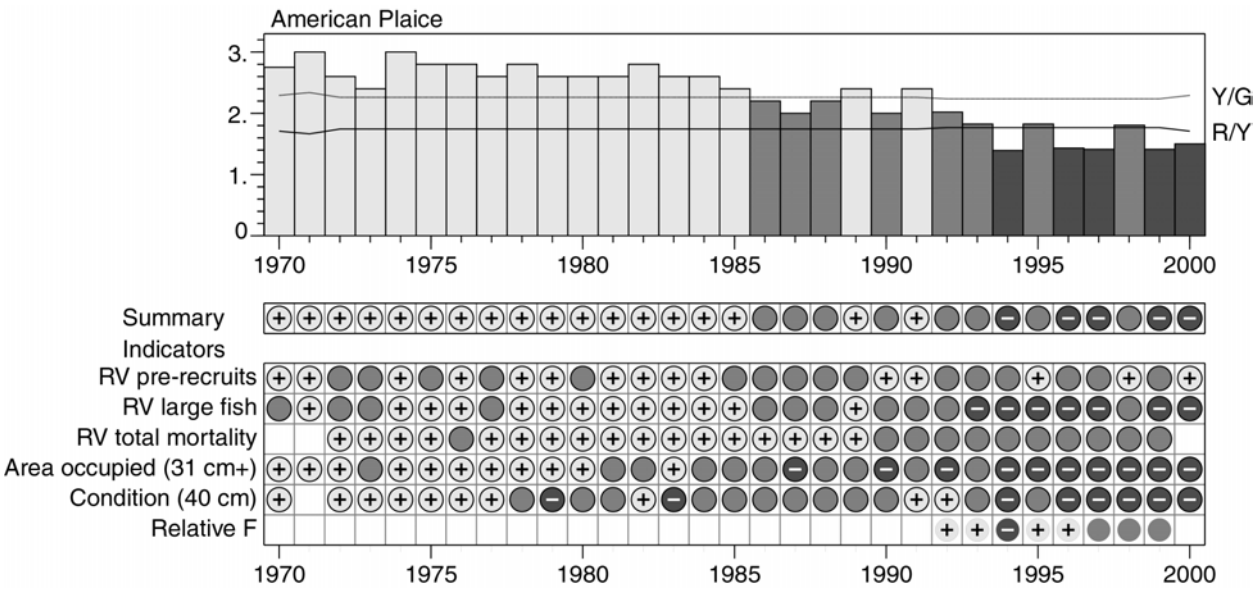


Figure 34. Traffic Light table summarizing stock status indicators for American plaice. For a given year, the value of each indicator is translated into a categorical code depicting a bad (red light ⊖), good (green light ⊕), or indeterminate (yellow light ●) sign of stock condition. Missing values are blank. The summary indicator represents the mean value across all indicators for a given year.

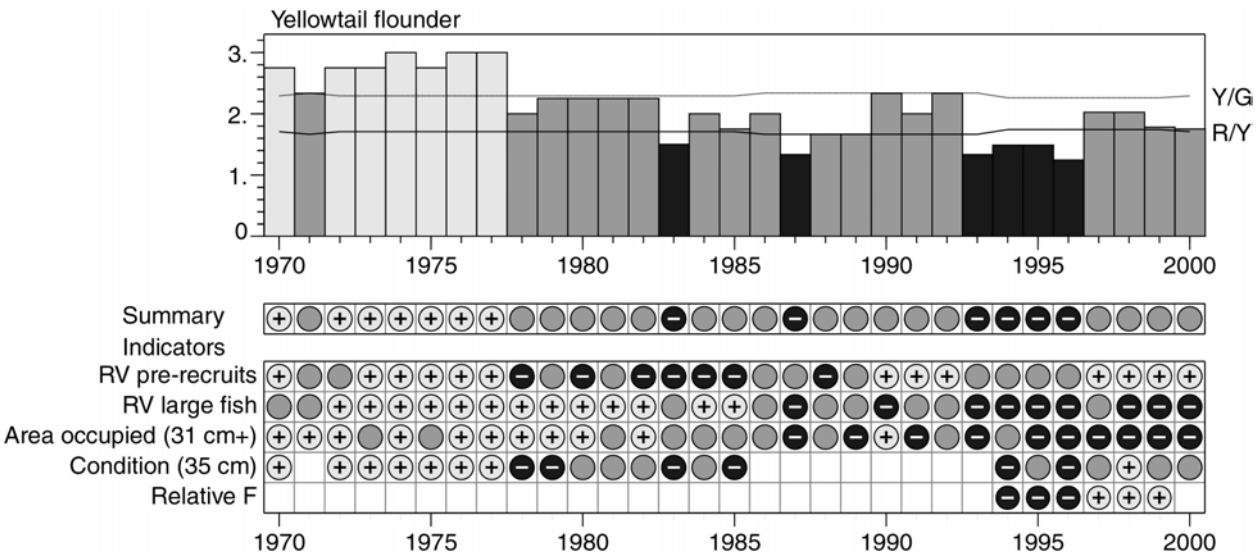
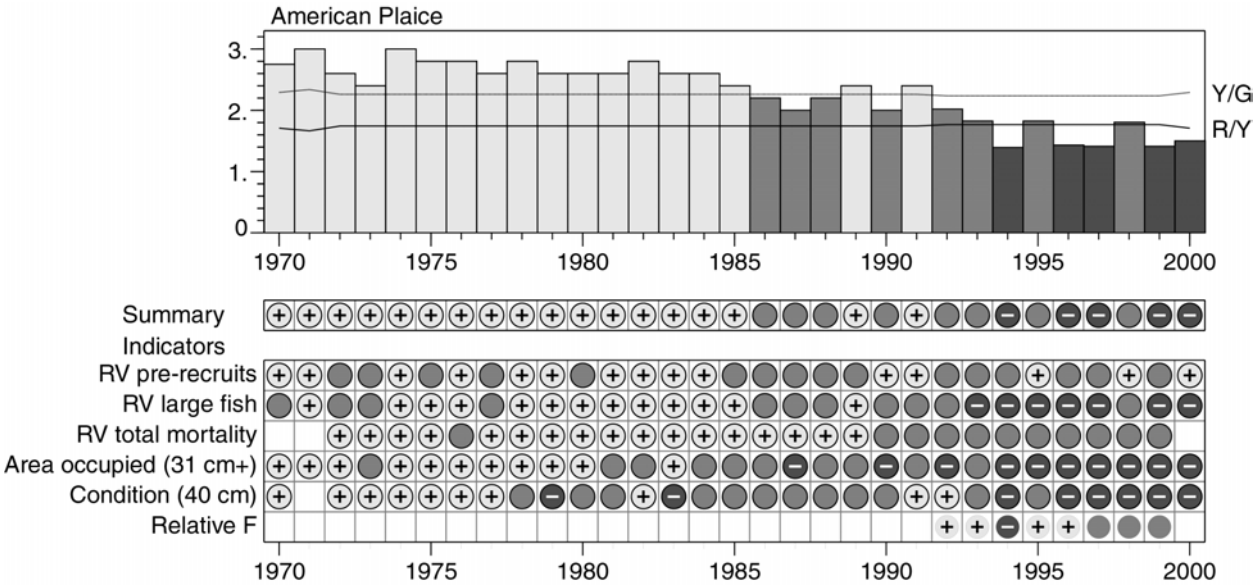
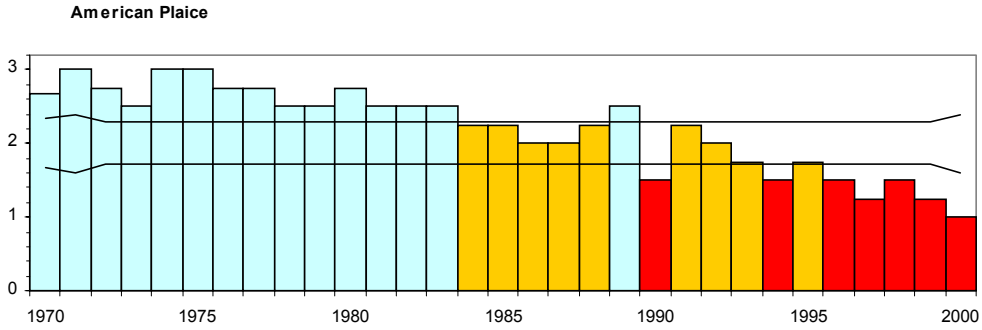


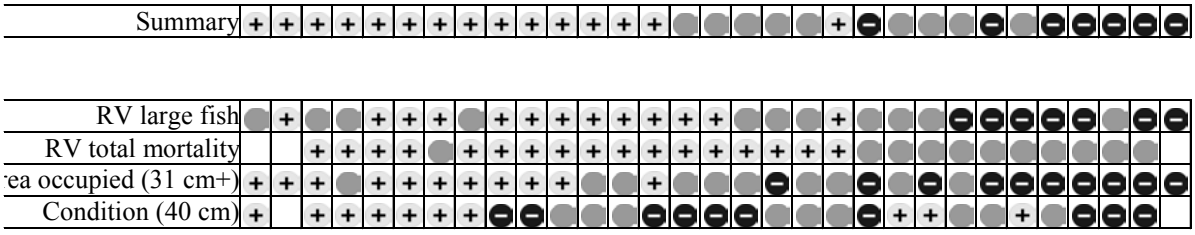
Figure 35. Traffic Light table summarizing stock status indicators for yellowtail flounder. For a given year, the value of each indicator is translated into a categorical code depicting a bad (red light ⊖), good (green light ⊕), or indeterminate (yellow light ●) sign of stock condition. Missing values are blank. The summary indicator represents the mean value across all indicators for a given year.

Appendix

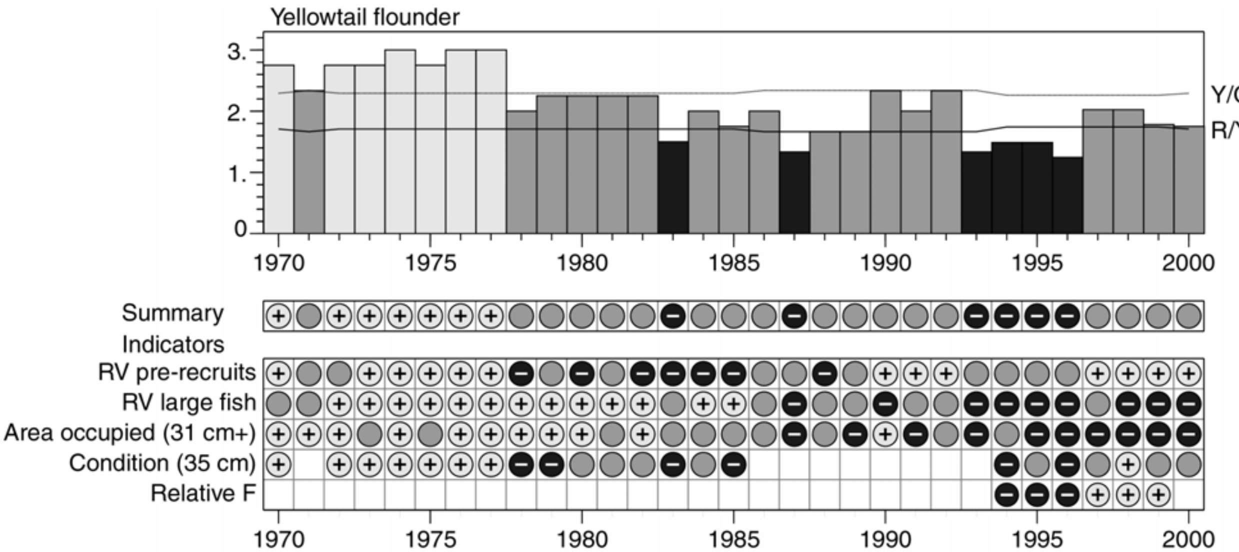
The following two pages compare the original Traffic Light tables for American plaice and yellowtail flounder in 4VW to revised counterparts in which we have removed the indicators of pre-recruit abundance and relative fishing mortality, and replaced the fish condition series with the corrected values.

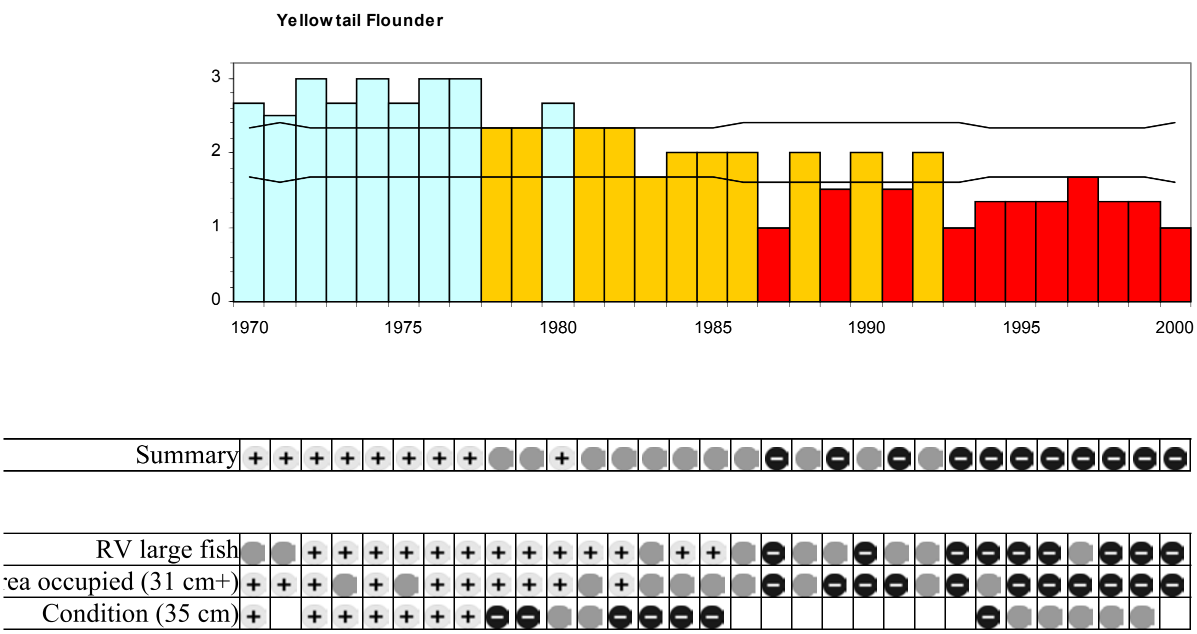






Traffic Light tables summarizing stock status indicators for American plaice. The upper table was included in the latest Stock Status Report. The lower table explicitly assumes a management objective of sustainable fishing, excluding any contentious or inapplicable indicators relative to this objective (RV pre-recruits, Relative F), and substitutes a corrected Condition factor. For a given year, the value of each indicator is translated into a categorical code depicting a bad (red light ⊖), good (green light ⊕), or indeterminate (yellow light ●) sign of stock condition. Missing values are blank. The summary indicator represents the mean value across all indicators for a given year. The lower table exhibits a little less variation of single years in relation to broader trends, but the message corresponds with the upper table.





Traffic Light tables summarizing stock status indicators for yellowtail flounder. The upper table was included in the latest Stock Status Report. The lower table explicitly assumes a management objective of sustainable fishing, excluding any contentious or inapplicable indicators relative to this objective (RV pre-recruits, Relative F), and substitutes a corrected Condition factor. For a given year, the value of each indicator is translated into a categorical code depicting a bad (red light ⊖), good (green light +), or indeterminate (yellow light ●) sign of stock condition. Missing values are blank. The summary indicator represents the mean value across all indicators for a given year. The messages in the two tables differ markedly, with the ambiguity of the recent situation in the upper table being replaced with a continuation of the 'condition red' signal in the lower table.