Summary of Key Topics from the TIQ Analytical Team Report

The Ad Hoc Groundfish Trawl Individual Quota (TIQ) Analytical Team presented preliminary results of ongoing analyses at the Ad Hoc TIQ Committee (TIQC) meeting in Portland, Oregon, October 25-26, 2004. The following summary excerpts the key information from those presentations.

Status Quo Management Regulations

What is the status quo against which individual fishing quotas (IFQs) or other management alternatives will be measured?

Status quo management for the trawl fishery is generally characterized by cumulative landing limits, closure of areas and depths (e.g., Rockfish Conservation Areas [RCAs]), and season management for Pacific whiting. The need for increased bycatch monitoring has been generally recognized and is part of the preferred alternative that was adopted under the programmatic bycatch environmental impact statement (EIS). Increased funding commitment is also needed to adequately enforce status quo regulations. While resulting in higher program costs than is currently the case, such changes are needed to achieve adequate control under the status quo management system and should, therefore, not be counted as new costs under an IFQ program.

Management Measures Remaining in Place with IFQs

Which current management measures would remain in place, and which would be replaced under an IFQ program?

Many management measures, including RCAs, are likely to remain in place with or without IFQs. Likewise, restrictions on trawl gear such as maximum footrope diameter and minimum net mesh size would likely remain in place. Such restrictions will continue to be necessary under any management system in order to reduce the mortality of overfished species. The main features of the current management system that would likely disapppear under an IFQ program are (cumulative) trip limits. This along with IFQs would give vessels more control over the timing of fishing trips and deliveries, thereby increasing efficiency and net value.

Harvest Levels Under Status Quo Polices

What harvest levels might be expected under status quo harvest policies?

The present fishery is characterized by significant underharvest of available catch optimum yield (OY) for many species - only approximately half of the available OY is being taken (Table 1). The harvest of target species OYs for the foreseeable future will continue to be constrained by overfished species.

Subject to the constraints imposed by species under rebuilding plans, opportunities may exist for reduced discard and fuller utilization of catch OYs. A carefully designed IFQ program (and possibly other program alternatives) may provide incentives to modify gear and strategies to retain more catch and access more of the available OY.

Bycatch (Discard of Incidental Catch)

How much of the current bycatch problem might potentially be resolved by an IFQ program?

What are the reasons for and current volume of discards?

The Enhanced Data Collection Program collected data between 1995 through 1999 on the reasons for discards. The primary reasons listed for discard were market constraints (68%), followed by regulations (24%), and quality reasons (8%). The West Coast Groundfish Observer Program (WCGOP) collects similar data. Opportunity to examine this data would help attain a greater understanding of the impact of the current fishery management system.

Present information on discard is limited. Estimates of total catch including discard mortality for 2002 and 2003 are provided in Tables 2 and 3. Estimated discards remain high especially for highly regulated species, although there was an overall reduction in discard in commercial fisheries between 2002 and 2003 (Table 1). Updated total catch mortality estimates by fishery sector, including adjustments for depth and management period, are currently on hold pending the receipt of discard data from the WCGOP.

What effect may IFQ programs have on discards, and what design elements might tend to increase or decrease discards?

A combination of present management measures and new IFQ tools could be used to reduce bycatch under an IFQ program. While multispecies fisheries managed under IFQs have had mixed success, British Columbia experienced a reduction in discard, albeit with an underachievement of the total allowable catch (TAC) for many species. Success in reducing discards in the British Columbia program was attributed to linking quota to total catch (including bycatch) instead of only landings, requiring 100% observer coverage, quota transferability, and creating strong disincentives for failing to cover catch with quota. Table 4 identifies several IFQ program features that may be useful in reducing at-sea discards under an IFQ program.

Need for Area Management of IFQs

Is a redistribution or concentration of catch more likely to occur under an IFQ program than under status quo?

The ability to divide and transfer quota shares under an IFQ system will increase the likelihood that fishing activities will be responsive to influences in the socioeconomic environment. These

influences are muted under the current management system with its trip limits and indivisible permits. While the degree and direction of shift is not predictable, there is an increased likelihood of geographic shifts in fishing activity under IFQs compared with the current system.

What kind of geographic shifts have been observed historically?

Under past and present fisheries management, except for the recent application of depth or area specific regulations, distribution of fishing effort has not generally been constrained. Generally, maps of survey biomass for lingcod, sablefish, and Dover sole show changes in concentration over time, but relatively less association with latitude (Figures 1, 2 and 3). Maps of historical catch demonstrate strong variability over time with some changes over latitude, but these trends do not always correspond with those indicated by the biomass surveys. It is not apparent that fishing effort necessarily follows high survey biomass or catch per unit effort (CPUE) under the current management system. Restrivtive cumulative limits may be acting to even out the geographic distribution of harvest. Relief from these limits may result in a redistribution of catch.

What biological concerns might be associated with an increase in the concentration of harvest in some areas?

The Canadian government adopted an area allocation scheme for conservation reasons. To the degree stock information was available, area allocation was used to prevent overfishing within these sub-areas (due to possible effort concentration) and to achieve yields appropriate to the productivity of these areas. In addition, area allocation was prescribed as a precautionary measure for a mixed stock fishery in the absence of clear-cut stock information. Area allocation was designed to prevent overfishing and possible localized and/or serial depletion of resources.

While the existence of potentially adverse concentrations of effort in the current West Coast fishery is unknown, area management may be a useful precautionary tool for preventing overfishing within sub-areas of groundfish stocks. While data available for most West Coast groundfish species is probably not sufficient to allocate OY to finely-drawn geographic areas, area allocation of OY should be considered at least for species that have known problems of localized depletion (lingcod) or are judged to have a high potential for localized depletion.

Stock assessment scientists, fishery stakeholders, and managers should jointly evaluate whether or not area management of OYs will improve stock assessments, sustainability, and overall yield. If area management is found to be a preferred alternative, then these groups should also be instrumental in defining management areas.

Economic Impacts under IFQs

What is the effect of IFQs on asset values?

Theory suggests that the value of assets, such as permits and quotas, is a measure of the discounted stream of profit expected to be generated by that asset. Factors, such as ecological uncertainty, external economic occurrences, and uncertainty associated with management of the resource, can influence this value. It is likely that implementing IQs a new type of asset, will influence the value

of existing assets like permits, vessels, and plants. For example there are theoretical reasons to believe that implementing IFQs would likely reduce the value of existing groundfish limited entry permits, as possession of the permit and vessel would no longer be sufficient for the holder to engage in fishing. Additionally, if fleet consolidation occurs under IFQs, there will be a surplus of available permits.

Economic theory also suggests that vessel values will be affected under an IFQ system. Vessel values will be influenced by the level of consolidation that occurs, the ability of new entrants to gain access to the resource and to other fisheries, and the flexibility of current permit owners to adjust their operations in response to IFQ implementation.

The available literature provides no consensus on how processor assets would be affected by implementation of IFQs, except to indicate that consolidation of quota and other changes under an IFQ program can result in the occurrence of stranded capital.

What is the potential for efficiency gains under IFQs?

Efficiency changes expected under an IFQ management system typically occur through four mechanisms: fleet restructuring, increased efficiency of individual vessels, shifting of harvesting to relatively more efficient vessels, and/or increased product value.

Studies of efficiency gains from IFQ implementation vary in key factors, such as species under management, features of the IFQ program, harvesting technology, and data availability. Most studies have also focused primarily on vessels, so the potential effects on processors' efficiency are less studied. Results vary considerably, but many studies show substantial efficiency gains resulting from reductions in vessel harvesting cost. Forty percent reductions in harvesting costs were noted in some studies, achieved chiefly through the retirement of less efficient vessels. A number of studies estimated annual efficiency gains under IFQs of over $10 million.

The Northwest Fisheries Science Center (NWFSC) is undertaking a cost-earnings survey of the limited entry trawl fleet during the first quarter of 2005. An effort was also initiated at the October 2004 TIQC meeting to collect costs and earnings data from West Coast groundfish processors. Results from these surveys will provide improved data for estimating the potential effects on costs, earnings, and efficiency of harvesting and processing sectors likely to result under an IFQ program.

How will IFQs affect enforcement and other program costs?

Increased bycatch monitoring and effort is needed to adequately enforce bycatch limits and other status quo regulations. Assuming adequate tracking and monitoring elements are put in place (including 100% at-sea coverage and a dockside monitoring program), very little additional enforcement effort would be required to implement an IFQ program. Full time equivalent estimates have been developed by the Ad Hoc TIQ Enforcement Group and are forthcoming.

Other major program costs associated with initial development and setup of an IFQ program include expenditures for issuing initial quota, tracking and matching quota with catch (software and database programming), and managing an appeals process.

Depending on final program design, other administrative costs may include: administering a database to analyze alternative allocations, setting up a quota market, upgrading methods and devices for recording landings, administering community development programs, conducting community education and outreach, and establishing a program for accommodating new entrants.

IFQ Allocation Issues

Initial allocation of IFQ will be one of the most contentious issues. There are many decision points along the way. The following discussion summarizes a few main issues.

Data Quality Issues

If allocation of individual species quotas will be based on historical landings, it is important to understand the limitations of using available Pacific Coast Fisheries Information Network (PacFIN) data for that purpose. Initially, landings of many rockfish and other groundfish species are recorded in PacFIN as "nominal" or "unspecified" categories. This was especially true for rockfish species landed prior to 1999. These landings are later assigned to other PacFIN categories by applying sample-based distributions of average species composition to the generic category totals. However, sample coverage and species assignments are not uniform along the West Coast, not all the generic categories are reassigned to specific categories, and since average catch distributions are applied, any particular individual's fishing practices are not accurately represented. As a result of these factors, catch histories for some vessels appear with more than half their total annual catch still residing in generic species categories (Figure 4).

Limited Entry Vessels Using Open Access Gear

The Council will need to determine whether or not groundfish taken by limited entry (LE) trawlers while engaged in other fisheries will be subject individual quotas. Limited entry trawlers also engage in other fisheries, sometimes directly targeting groundfish species or taking groundfish as incidental catch. Data for 1998 indicate that 80 LE trawl vessels landed a total of 280,000 pounds of groundfish against their open access limits. In 2003, 16 LE trawl vessels landed 154,000 pounds of groundfish using open access gears.

TABLE 1. (HL1.1) Estimated catch (including discard) and target OY (or ABC - in boxes) for the 2002 and 2003 West Coast groundfish fishery, and percentage over or under target harvest levels.

	2002					2003				
	Estimated Catch	Estimated Discard	%Discard	OY (ABC in boxes)	% Over or Under	Estimated Catch	Estimated Discard	%Discard	OY (ABC in boxes)	% Over or Under
Lingcod	980	159	16.2%	577	69.8%	1,367	71	5.2%	651	109.9%
Pacific Cod	798	42	5.2%	3,200	-75.0%	1,323	74	5.6%	3,200	-58.7%
Pacific Whiting	132,368	2,369	1.8%	129,600	2.1%	142,914	1423	1.0%	148,200	-3.6%
Sablefish (north)	4,330	702	16.2%	4,367	-0.8%	6,387	1126	17.6%	6,500	-1.7%
Sablefish (south)	190		0.0%	229	-17.1%	204		0.0%	294	-30.6%
Dover sole	7,584	1,265	16.7%	7,440	1.9%	8,342	957	11.5%	7,440	12.1%
English sole	1,594	415	26.0%	3,100	-48.6%	1,241	339	27.3%	3,100	-60.0%
Petrale sole	1,965	167	8.5%	2,762	-28.8%	2,161	144	6.7%	2,762	-21.8%
Arrowtooth flounder	4,979	2,889	58.0%	5,800	-14.1%	3,244	905	27.9%	5,800	-44.1%
Other flatfish	2,337	634	27.1%	7,700	-69.7%	2,094	491	23.4%	7,700	-72.8%
Pacific Ocean Perch	185	34	18.6%	350	-47.1%	160	22	13.7%	377	-57.5%
Shortbelly	12	11	97.5%	13,900	-99.9%	9	2	24.7%	13,900	-99.9%
Widow	547	193	35.4%	856	-36.1%	58	16	27.8%	832	-93.0%
Canary	110	41	37.6%	93	18.0%	47	14	30.4%	44	6.4%
Chilipepper	249	74	29.7%	2,000	-87.6%	50	15	31.1%	2,000	-97.5%
Bocaccio	140	29	20.4%	100	40.3%	29	8	29.2%	20	45.5%
Splitnose	79	23	28.6%	461	-82.8%	119	9	7.8%	461	-74.2%
Yellowtail	1,532	286	18.6%	3,146	-51.3%	504	22	4.4%	3,146	-84.0%
Shortspine Thornyheads	1,156	389	33.7%	955	21.0%	1,220	388	31.8%	955	27.8%
Longspine Thds. North	2,098	373	17.8%	2,461	-14.7%	1,835	324	17.7%	2,461	-25.4%
Longspine Thds. South	125			195	-36.1%	153			195	-21.5%
	72						0			
Cowcod, Monterey	2	1	65.0%	2.4	-8.3%	0		0.0%	2	200.0%
Cowcod, Conception	0			2.4	-100.0%	0			2	-100.0%
Yelloweye	11	2	19.0%	13.5	-17.0%	8	2	19.0%	22	-63.2%
Darkblotched	202	96	47.6%	168	20.4%	140	52	37.0%	172	-18.7%
Black Rockfish (north)						174			615	-71.7%
Black Rockfish (south)						976			500	95.2%
Black Rockfish Total						1,150			1,115	3.1%
Total (including whiting)	163,647	10,194	6.2%	189,478	-13.6%	173,218	6,403	3.7%	212,466	-18.5%
Total (excluding whiting)	31,279	7,826	25.0%	59,878	-47.8%	30,304	4,981	16.4%	64,266	-52.8%

TABLE 2. (BC1.3) Draft estimated 2002 total catch mortality of selected groundfish species from West Coast commercial, tribal and recreational fisheries (mt).[a/]

	LANDINGS AND MORTALITY			TARGETS		DISCARDS				
Species	Estimated Total Catch	PRELIMINARY Estimated Commercial Fishery Discard Mortality[b/]	Actual Landings[c/]	Total Catch ABC	Total Catch OY	Shoreside Discard	Shoreside Discard Mortality	At-Sea Whiting Bycatch	Mortality from Fixed Gear Sablefish (all north)	Mid-water Widow/ Yellowtail Fishery (Period 6)
Lingcod	980.0	159.1	820.9	841	577	313.5	156.7	0.5	1.8	0.1
Pacific Cod	798.5	41.8	756.7	3,200	3,200	41.8	41.8			
Pacific Whiting[d/]	132,367.9	2,368.5	129,999.4	188,000	129,600	2,312.2	2,312.2			56.3
Sablefish (north)	4,330.4	701.6	3,628.8	8,209	4,367	1,285.0	642.5		59.1	
Sablefish (south)	189.8		189.8	441	229					
Dover sole	7,583.8	1,264.8	6,319.0	8,510	7,440	1,264.8	1,264.8			
English sole	1,594.5	415.2	1,179.3	3,100		415.2	415.2			
Petrale sole	1,965.4	167.3	1,798.1	2,762		167.3	167.3			
Arrowtooth flounder	4,979.3	2,888.6	2,090.7	5,800		2,888.6	2,888.6			
Other flatfish	2,336.7	633.5	1,703.2	7,700		633.5	633.5			
Pacific Ocean Perch	185.3	34.5	150.8	689	350	30.5	30.5	3.8	0.0	0.1
Shortbelly	11.7	11.4	0.3	13,900	13,900	11.4	11.4			
Widow	547.0	193.5	353.5	3,871	856	3.3	3.3	154.7	0.0	35.5
Canary	109.7	41.2	68.4	272	93	32.1	32.1	5.2	1.3	2.7
Chilipepper	249.0	74.0	175.0	2,700	2,000	74.0	74.0			
Bocaccio	140.3	28.6	111.7	198	100	28.0	28.0	0.6		
Splitnose	79.1	22.6	56.5	615	461	22.6	22.6			
Yellowtail	1,532.3	285.6	1,246.6	3,146	3,146	285.6	285.6			
Shortspine Thornyheads	1,155.7	389.4	766.3	1,004	955	389.4	389.4			
Longspine Thds. (north)	2,098.4	373.3	1,725.1	2,461	2,461	373.3	373.3			
Longspine Thds. (south)	124.7		124.7	390	195					
Unspecified Thornyheads	71.6		71.6							
Cowcod, Monterey	2.2	1.4	0.8	19	2.4	1.4	1.4			
Cowcod, Conception	0.0		0.0	5	2.4					
Yelloweye	11.2	2.1	9.1	52	13.5	0.5	0.5		1.6	
Darkblotched	202.2	96.3	105.9	205	168	93.0	93.0	3.2	0.1	

a/ Preliminary estimates of total catch mortality based on species discard assumptions used when the OYs were set. These assumptions are currently being revised using data from the West Coast Groundfish Observer Program.

b/ Preliminary estimated discard mortality in the commercial fishery. Preliminary trawl discard calculated by applying discard mortality rates from combined 2001-03 West Coast Groundfish Observer Program data to 2002 trawl logbook data, by area and depth strata. Discard totals estimated for tows recorded in logbooks are expanded using state-specific ratios of fishticket landings to retained logbook catch. Because tows conducted under Exempted Fishing Permits could not currently be removed from logbooks and fishtickets, applying fleetwide discard rates to these tows may overstate discard for some shelf species. This column also includes at-sea discards of rebuilding species. Preliminary fixed-gear discard in the directed sablefish fisheries is calculated by applying discard mortality rates from combined 2001-03 West Coast Groundfish Observer Program data to northern sablefish landings data. No logbooks are available for fixed-gear vessels. Because of the limited geographic coverage of available data, fixed-gear discard amounts for species caught off central California are not well estimated at this time.

c/ Includes shoreside commercial and tribal landings from PacFIN, observed total catch including estimated discards in the at-sea whiting fishery, and RecFIN recreational catch plus observed discard mortality (A+B1).

d/ Discards of whiting are estimated from observer data and counted towards the OY inseason.

TABLE 3. (BC1.4) Draft estimated 2003 total catch mortality of selected groundfish species from West Coast commercial, tribal and recreational fisheries (mt).[a/]

	LANDINGS AND MORTALITY			TARGETS		DISCARDS			
Species	Estimated Total Catch	PRELIMINARY Estimated Commercial Fishery Discard Mortality[b/]	Actual Landings[c/]	Total Catch ABC	Total Catch OY	Shoreside Discard	Shoreside Discard Mortality	At-sea Whiting Bycatch	Mortality from Fixed-gear Sablefish (All, North of 36°)
Lingcod	1,355.6	70.7	1,284.9	841	651	137.8	68.9	0.5	1.3
Pacific Cod	1,323.1	73.5	1,249.6	3,200	3,200	73.5	73.5		
Pacific Whiting[d/]	142,913.8	1,422.7	141,491.1	188,000	148,200	1,422.7	1,422.7		
Sablefish (north)	6,386.6	1,126.1	5,260.5	8,209	6,500	2,067.4	1,033.7		92.4
Sablefish (south)	204.0		204.0	441	294				
Dover sole	8,342.2	956.6	7,385.7	8,510	7,440	956.6	956.6		
English sole	1,241.4	339.0	902.4	3,100		339.0	339.0		
Petrale sole	2,160.6	144.4	2,016.2	2,762		144.4	144.4		
Arrowtooth flounder	3,243.5	904.8	2,338.7	5,800		904.8	904.8		
Other flatfish	2,093.5	490.7	1,602.8	7,700		490.7	490.7		
Pacific Ocean Perch	160.1	21.9	138.2	689	377	15.5	15.5	6.3	
Shortbelly	9.3	2.3	7.0	13,900	13,900	2.3	2.3		
Widow	57.9	16.1	41.8	3,871	832	1.7	1.7	14.4	
Canary	48.5	14.2	34.3	272	44	12.7	12.7	0.9	0.6
Chilipepper	49.5	15.4	34.1	2,700	2,000	15.4	15.4		
Bocaccio	29.1	8.5	20.6	198	20	8.2	8.2	0.3	
Splitnose	118.8	9.3	109.5	615	461	9.3	9.3		
Yellowtail	504.5	22.1	482.4	3,146	3,146	22.1	22.1		
Shortspine Thornyheads[e/]	1,220.2	387.8	832.4	1,004	955	387.8	387.8		
Longspine Thds. North[e/]	1,834.8	323.9	1,510.9	2,461	2,461	323.9	323.9		
Longspine Thds. South	0.0			390	195				
Cowcod, Monterey	0.4	0.2	0.1	19	2.4	0.2	0.2		
Cowcod, Conception	0.0		0.0	5	2.4				
Yelloweye	8.1	1.5	6.6	52	22.0	0.3	0.3		1.3
Darkblotched	139.9	51.8	88.1	205	172.0	47.3	47.3	4.32986	0.2
Black Rockfish (north)	174.0		174.0	615					
Black Rockfish (south)	976.1		976.1	500					
Black Rockfish Total	1,150.1		1,150.1	1,115					

a/ Preliminary estimates of total catch mortality based on species discard assumptions used when the OYs were set. These assumptions are currently being revised using data from the West Coast Groundfish Observer Program.

b/ Preliminary estimated discard mortality in the commercial fishery. Preliminary trawl discard calculated by applying discard mortality rates from combined 2001-03 West Coast Groundfish Observer Program data to 2002 trawl logbook data, by area and depth strata. Discard totals estimated for tows recorded in logbooks are expanded using state-specific ratios of fishticket landings to retained logbook catch. Because tows conducted under Exempted Fishing Permits could not currently be completely removed from logbooks and fishtickets, applying fleetwide discard rates to these tows may overstate discard for some shelf species.

In an effort to minimize this problem, rockfish discard from target tonnage caught within the RCA off Oregon was estimated using bycatch rates from that EFP. Since the Washington EFP included full retention of shelf rockfish, no at-sea discard of these species was estimated for tows occuring within the RCA off Washington, or on tows that exceeded the 2-month allowance of arrowtooth flounder outside the EFP. This column also includes at-sea discards of rebuilding species. Preliminary fixed-gear discard in the directed sablefish fisheries is calculated by applying discard mortality rates from combined 2001-03 West Coast Groundfish Observer Program data to northern sablefish landings data. No logbooks are available for fixed-gear vessels. Because of limited geographic coverage of available data, fixed-gear discard amounts for species off central California are not well estimated at this time.

c/ Includes shoreside commercial and tribal landings from PacFIN, observed total catch including estimated discards in the at-sea whiting fishery, and RecFIN recreational catch plus observed discard mortality (A+B1).

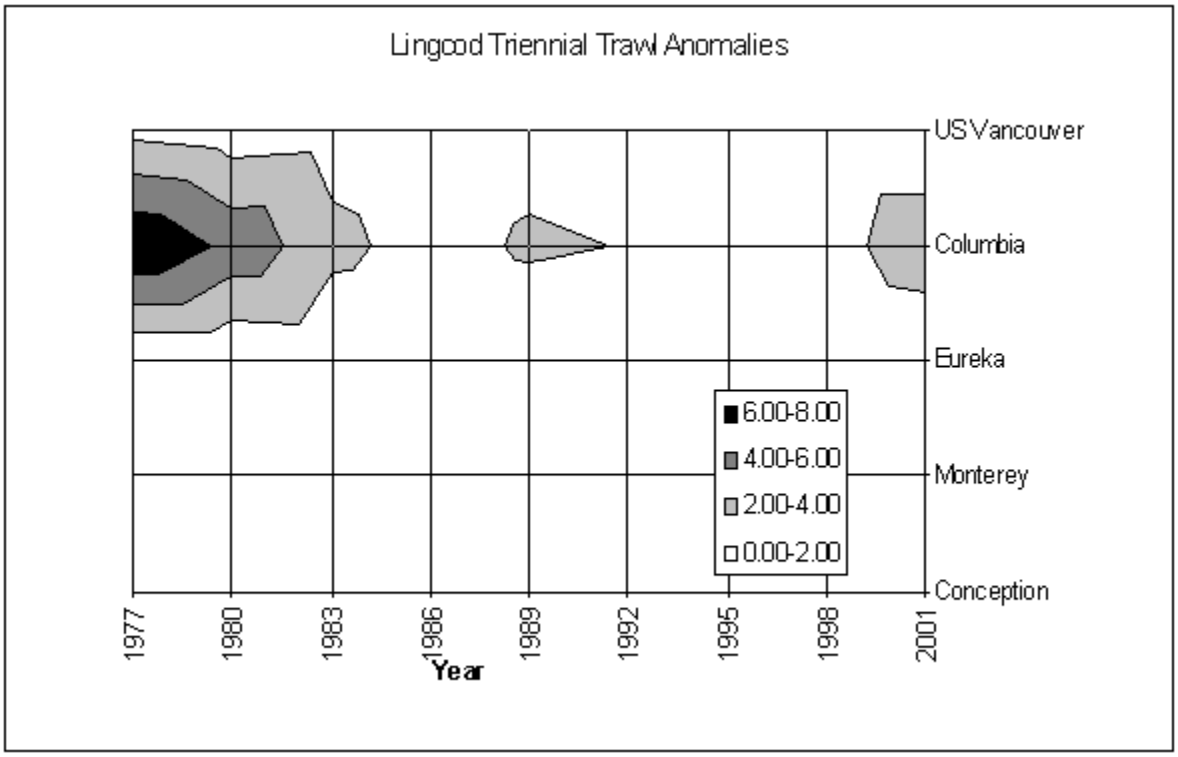
d/ Discards of whiting are estimated from observer data and counted towards the OY inseason.

e/ Includes "unspecified thornyheads" allocated based on ratios estimated from California landings and At Sea north/south ABCs.

TABLE 4. (BC1.8) Tools potentially useful in reducing bycatch (at-sea discards) under an IFQ program for the West Coast groundfish trawl fishery - adapted from Quigley (2004).

IQ Tool	How it Potentially Reduces Bycatch	Potential Downsides
Quota transferability	Quota transfer may lead to concentration of effort and increase in shares per vessel, potentially reducing the number of occasions a vessel comes up against a quota limit. Transferability also allows purchase of quota needed in areas of high bycatch.	High transaction costs. Concentration of shares due to transfers lead to adverse economic shifts.
Incorporation of overfished species into the IQ program	Reducing bycatch of overfished species can permit more access to target species; bycatch quota shares can thus be freed and used in high bycatch rate areas.	If quota shares for overfished species are small, the IQ managed fishery could be influenced by excessive catches of these species in non-IQ fisheries receiving an overall allocation.
Incorporation of other gear types into the IQ program	If all sectors fishing in an IQ species are in an IQ program and shares could be transferred between sectors, then sectors with an IQ deficit could purchase surplus shares and reduce bycatch by finding covering shares.	Difficulty allocating and manageing shares to sectors with a large number of participants - (recreational fishery).
Incorporation of non-marketable species into the IQ program	Prevents excessive fishing pressure on non-IQ and formerly non-marketable species; can also create a controlled environment for development of new markets.	May be no survey or assessment data to determine appropriate OY and IQ shares. Extra cost to IQ fishermen to purchase shares for a low value species.
Quota market that is convenient and easy to use.	Creates a central location for sellers/buyers to locate shares and keeps transaction costs low. Allows those needed quota to 'cover' catch with purchased shares to do so - a disincentive to discarding species with little or no share remaining at time of capture.	Quota shares may not be available when needed or price may be substantially higher than market value. A government created market may be cost prohibitive - tracking costs may be prohibitive.
Full observer coverage	Increased accountability, eliminates incentive to discard fish that will count against quota share.	Less than 100% observer coverage and or video monitoring would leave the door open to high-grading and discarding of fish not covered by quota share.
Carryover provisions	Provides a means of handling catch in excess of quota share - reduces incentives to discard instead of landing fish.	Additional tracking costs.
Adequate penalities for overcatches	Provides incentive to incorporate selective fishing strategies that minimize bycatch of overfished or prohibited species, promotes individual accountability.	If penalities are too high, or the threshold for application of penalties is too low, incentives for discarding might increase.
Education program	Knowledge of impact of at-sea discards on the resource and IQ holdings and value provide incentives for minimizing waste.	

FIGURE 1. (A1.1a) Lingcod triennial trawl anomalies by INPFC area (1977-2001) and commercial catch anomalies by INPFC area (1981-2003).



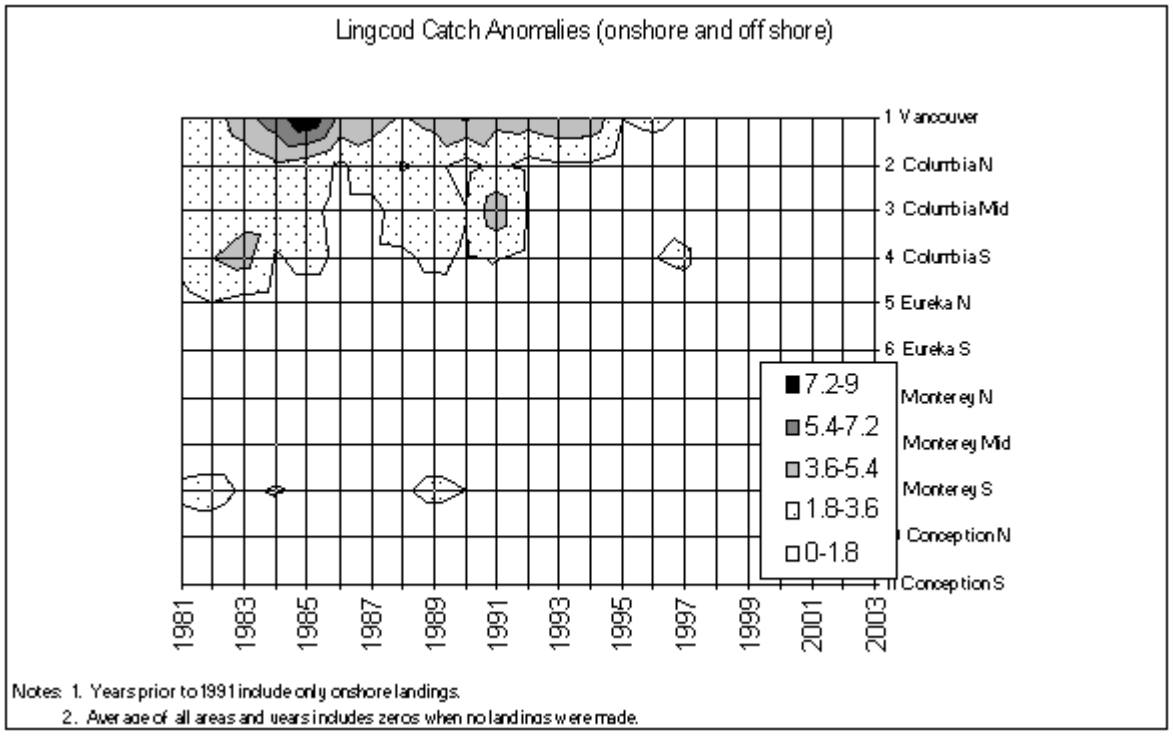
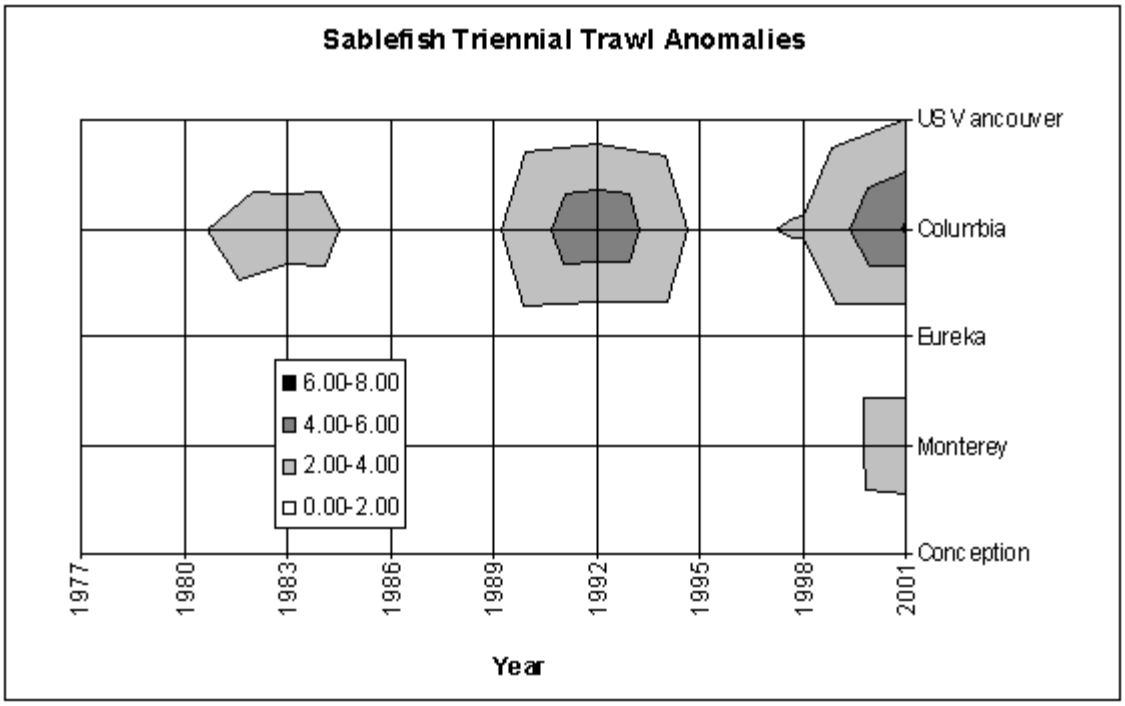


FIGURE 2 (A1.2a) Sablefish triennial trawl anomalies by INPFC area (1977-2001) and commercial catch anomalies by INPFC area (1981-2003).



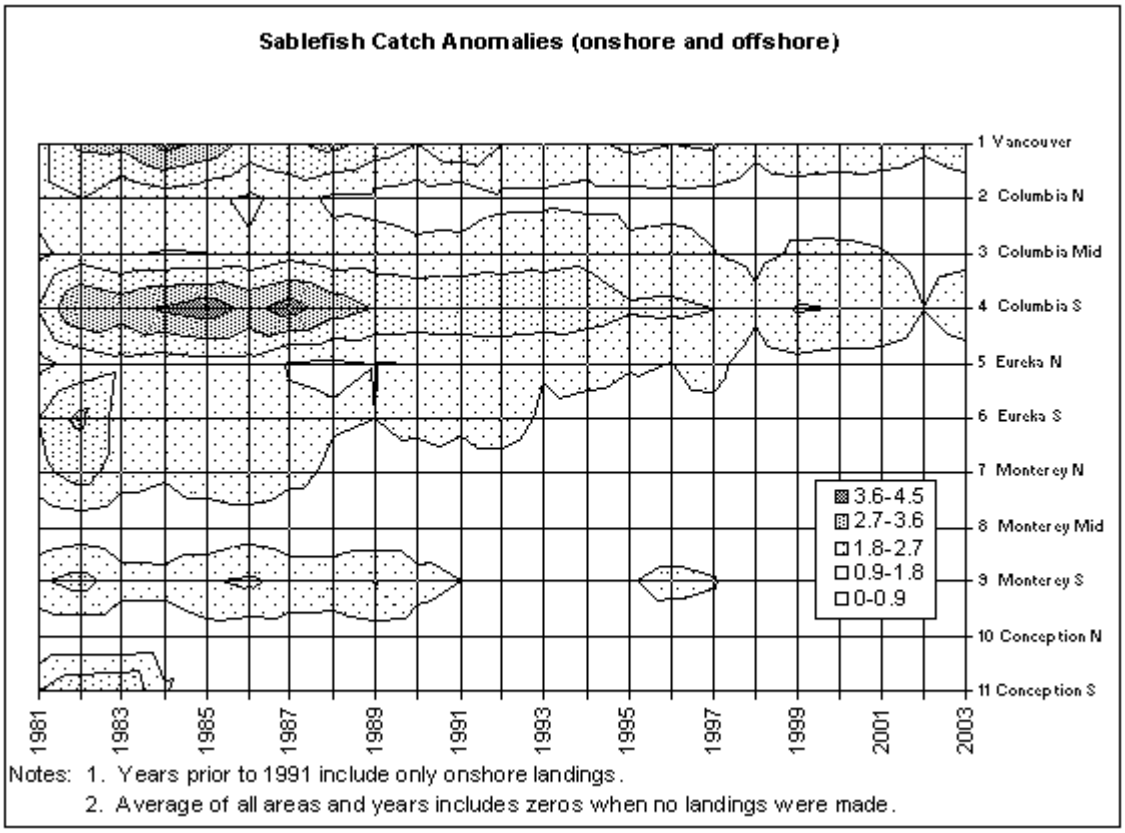
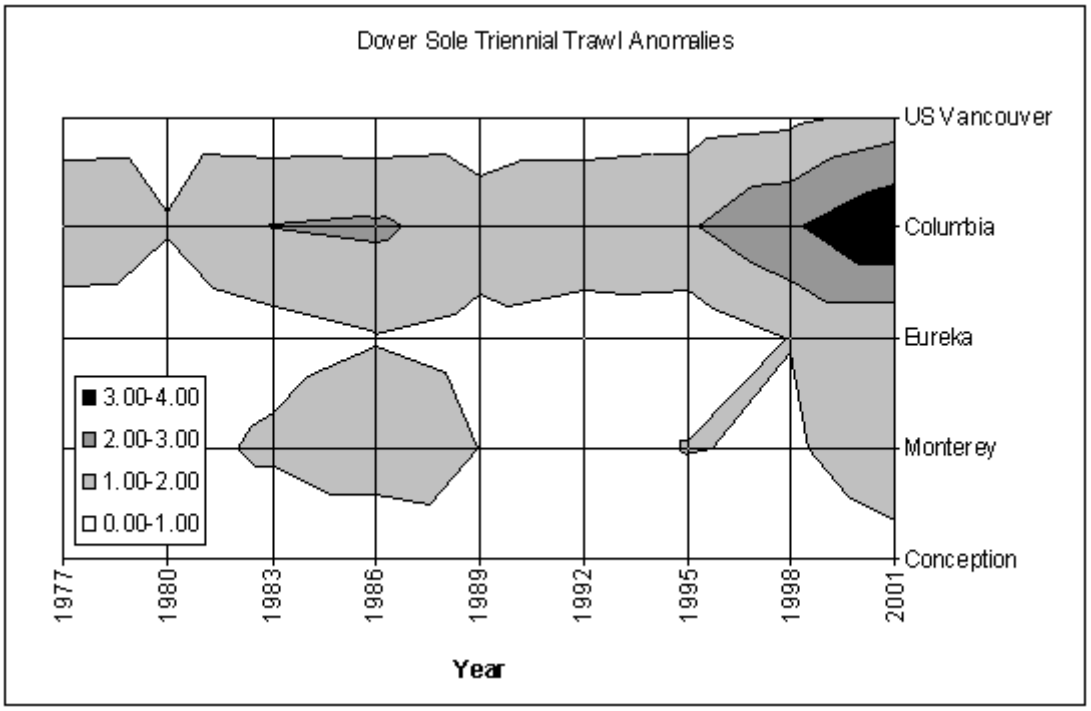


FIGURE 3 (A1.3a) Dover sole triennial trawl anomalies by INPFC area (1977-2001) and commercial catch anomalies by INPFC area (1981-2003).



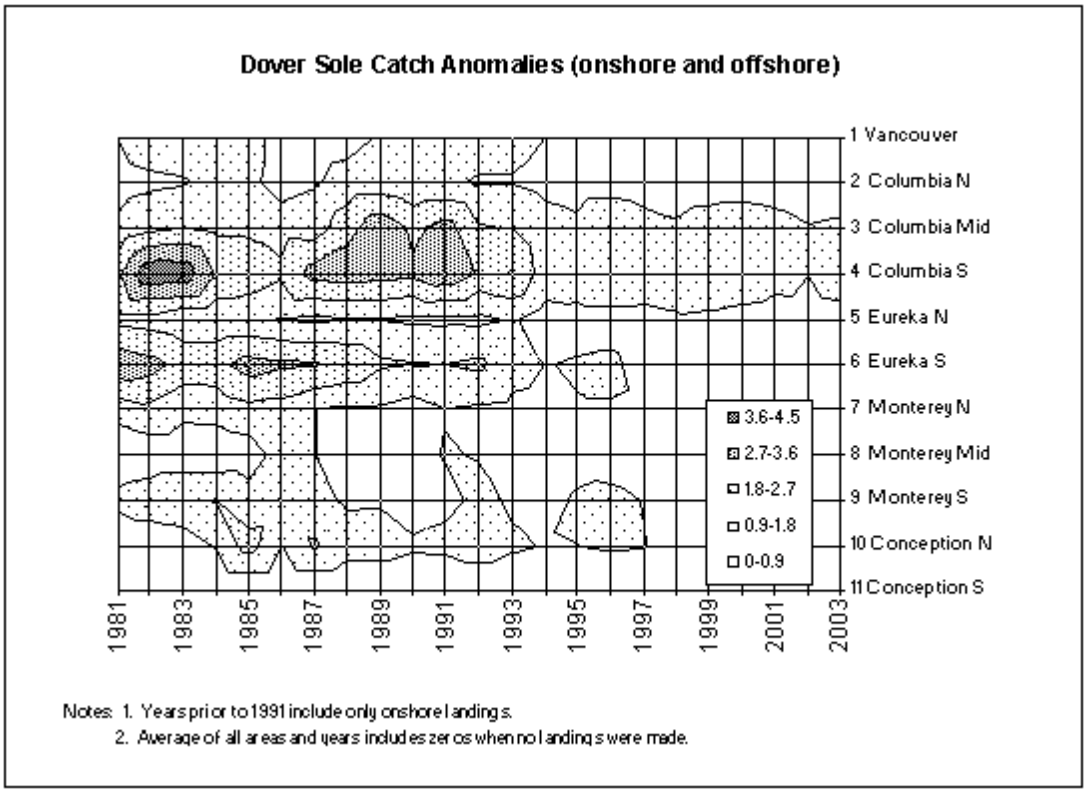
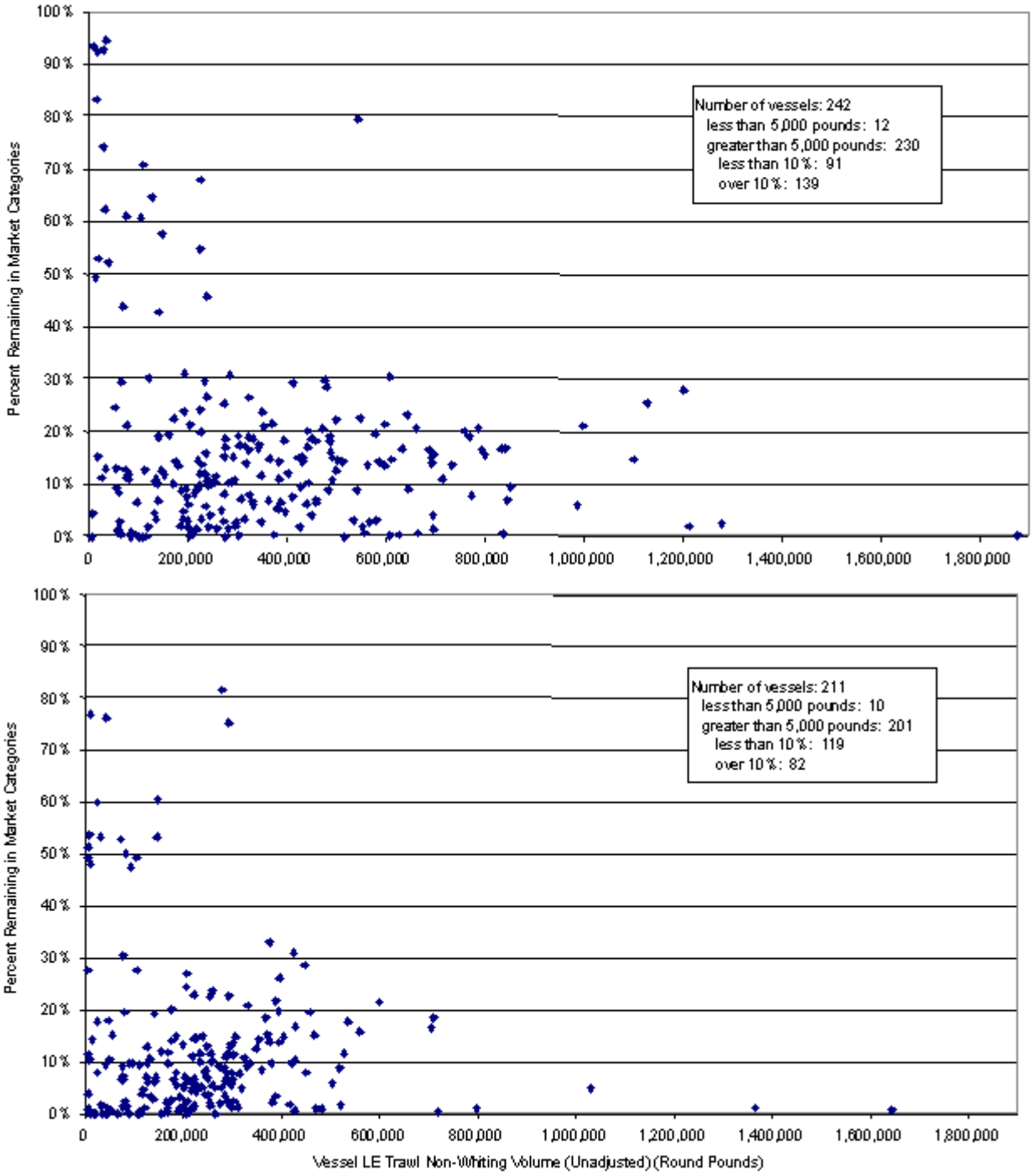


FIGURE 4. Remaining market category species after composition adjustment for LE Trawl Non-Whiting Groundfish vessels in 1998 (top) and 2003 (bottom)



Notes: 1. Market category adjusted species codes are for common name species descriptions starting with NOM, NOR, UNSP, OTHER, or containing MIXED.
2. Filtered for vessels landing at least 5,000 pounds of non-whiting groundfish LE trawl.