1998 REPORT OF THE SHARK EVALUATION WORKSHOP

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SUMMARY

This report was prepared in support of the Atlantic Shark Fishery Management Plan to provide an update on the status of shark resources in waters off the U.S. Atlantic and Gulf of Mexico coasts. To that end a Shark Evaluation Workshop (SEW) was held at the Southeast Fisheries Science Center, Panama City Facility, 22-26 June 1998. The 1998 Workshop focused on the large coastal shark grouping. The Workshop format was a mechanism for the National Marine Fisheries Service (NMFS) to obtain input into the process of scientific evaluation of shark status. This Report represents a summary and conclusions derived from analyses, which were largely the basis of discussions at the Workshop. However, this Report is a product of the scientific evaluation process of NMFS; and while every effort was made to consider the scientific viewpoints that were discussed at the Workshop, ultimately the Report represents the balancing of scientific views by NMFS and is not necessarily a consensus of those participating in the Workshop.

The 1996 SEW report had concluded that catch rates of many of the species and species groups declined by about 50 to 75% from the early 1970's to the mid 1980's, but that the rapid rate of decline that characterized the stocks in the early 1980's had slowed significantly in the 1990's. Partially based on results from the 1996 SEW report, a target of a 50% reduction in large coastal catch (relative to 1995) was selected. This was to be achieved through a 50% reduction in the commercial quota and through a reduction to a 2 fish bag limit in the recreational sector. The 1997 data indicated that commercial catches were, indeed, reduced relative to 1995 by more than 50% in numbers. However, recreational catches were reduced by only 12%. The recreational catch in numbers in 1997 was estimated to be greater than the commercial catches.

The most recent catch rate data corresponding to 1996 and 1997 continue to show inconsistent trends either upward or downward, and many of these trends are statistically insignificant. However, this is expected: although the fishery has now been regulated for five years, given that the expected rates of change in shark abundance are low and that the measures of stock abundance used are uncertain, a longer time series of catch rate estimates will be required to detect significant changes in stock size since implementation of the most recent management measures.

For large coastal catch rate indices covering the recent period (1993-97, since the advent of the FMP), 3 of 7 indices exhibit negative slopes (2 statistically significant) and 4 indicate positive slopes (1 significant). The largest annual rate of increase from these indices during this period was 17%, while the largest decrease was 29%. For sandbar during the period 1993-97, 4 of 5 indices exhibit positive slopes (1 significant) and only 1 showed a negative slope (not significant). The largest annual rate of increase from these sandbar indices during this period was 37%, while the only one exhibiting a negative slope, decreased at 1% annually. For blacktip during the period 1993-97, 2 of the 5 indices exhibit positive slopes and 3 indicate negative slopes. One of the positive slope indices and one of the negative slope indices were significant. The annual rate of change from these blacktip indices ranged from 34% to –19%.

Production model analyses utilizing catch, catch rate and demographic data were integrated using Bayesian statistical techniques. For the large coastal aggregation: current (1998) stock size was estimated to be between 30 and 36% of MSY levels, and 1997 catch was estimated to be 218-233% of MSY (the ranges are defined by the mean values from two alternative catch scenarios). When analyses were disaggregated into sandbar and blacktip sharks, then for sandbar current stock size was estimated to be between 58 and 70% of MSY levels, and 1997 catch was estimated to be 85-134% of MSY. For blacktip, current stock size was estimated to be between 44 and 50% of MSY levels, and 1997 catch was estimated to be 163-184% of MSY. Thus, projections indicated that the large coastal aggregate complex might still require additional reductions in effective fishing mortality rate in order to ensure increases of this resource toward MSY. For the blacktip shark, projections also indicated a need for additional reductions, but it is unclear whether reductions in the U.S. alone would achieve the intended goals. Projections for sandbar were more optimistic, suggesting that current catches are closer to replacement levels.

On the basis of recent life history analyses of the sandbar shark showing that large juvenile and subadult individuals are likely to be the most sensitive stages in this species, it was concluded that management approaches should be aimed at reducing fishing mortality in these stages. A minimum size limit of about 140 cm fork length on the "sandbar-like" ridgeback sharks was identified as a possible strategy to reduce mortality in juvenile and subadult stages of sandbar sharks. Additionally, using similar life history arguments, a minimum size was also suggested for the "blacktip-like" non-ridgeback sharks as a strategy for reducing fishing mortality. However, in the case of blacktip, it is expected that a commercial minimum size might not achieve desired results due to mortality of undersized blacktips during normal fishing operations.

Although the lack of data do not allow modeling analyses for dusky sharks, this species has exhibited a low frequency of occurrence in recent periods and has a life history that is especially susceptible to overfishing. Therefore, dusky sharks may warrant special concern.

To continue improving shark stock assessments, the need for continued collection of species- and size-specific catch (landed and discarded, U.S. and non-U.S.) and effort data and fishery-independent measures of shark abundance and productivity was recognized. While notable improvements in species-specific catch information have been made for a portion of the recent catches through observer data collections and several fishery-independent measures of *abundance, improved assessment advice will only result if these efforts are maintained and increased.*

Every effort should be made to manage species separately. New analyses indicate that individual species are responding differently to exploitation (as was suspected in previous SEW Reports). Management of large coastal aggregates can result in excessive regulation on some species and excessive risk of overfishing on others.

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BACKGROUND

The Fishery Management Plan (FMP) for Sharks of the Atlantic Ocean was implemented on 26 April 1993. The objectives of the FMP (p. 76) are to: 1) prevent overfishing of shark resources; 2) encourage management of shark resources throughout their range; 3) establish a shark resource data collection, research, and monitoring program; and 4) increase the benefits from shark resources to the U.S. while reducing waste, consistent with the other objectives. During preparation of the FMP, it was determined that stocks of Atlantic large coastal sharks were below the level required to produce the maximum sustainable yield (MSY). Accordingly, the FMP included a recovery plan designed to rebuild the resource to the MSY level, with annual total allowable catch (TAC) increasing as the rebuilding plan progressed.

A number of regulations were implemented to limit fishing mortality of shark resources in the U.S. western Atlantic and achieve FMP objectives. These include quotas for the large coastal and pelagic categories, recreational bag limits, a trip limit for large coastal species of 4,000 lb. per trip, and prohibition of the practice of removing the fins from a shark and discarding the carcass. In addition, the FMP calls for an annual evaluation of information on shark landings, current stock condition, MSY, and information on which to base the TAC. This information is to be developed by the National Marine Fisheries Service (NMFS) and submitted to the Operations Team as specified in the FMP.

To facilitate the evaluation in 1994, NMFS convened a group of scientists to examine the available data on shark resources and provide appropriate scientific advice. The Shark Evaluation Workshop (SEW) was held in Miami in the Southeast Fisheries Science Center (SEFSC) in March 1994. The most important conclusion from the Workshop Report was that "the weight of the evidence does not support the previous (FMP) recommendation that the 1994 or 1995 TAC should automatically increase". The SEW Report therefore recommended that "the projected quota increase for 1995 should be delayed indefinitely". Based on this recommendation, the FMP rebuilding plan, particularly the projected 1995 quota increases for large coastal sharks were rejected. The large coastal quota for 1995 and 1996 remained at the 1994 level of 2,570 mt. This quota would also apply in future years, unless future scientific analyses indicated otherwise in order to meet FMP objectives and/or to promote rebuilding of the shark resource.

A second meeting of the Shark Evaluation Workshop was held June 4-6, 1996 at the Southeast Fisheries Science Center in Miami, FL. An important conclusion from the Workshop Report was that "additional reductions in fishing mortality would improve the probability of stock increases for Large Coastal sharks. Analyses indicate that recovery is more likely to occur with reductions in effective fishing mortality rate of 50% or more". After consideration of the 1996 SEW Report by the NMFS Shark Operations Team and other pertinent factors, on April 2, 1997, NMFS implemented the following actions under the shark FMP: 1) reduced the annual commercial quota for large coastal sharks by 50% from 2,570 metric tons dressed weight (mt dw) to 1,285 mt dw; 2) established a commercial quota of 1,760 mt dw for small coastal sharks; 3) reduced the recreational bag limit to 2 sharks per vessel per trip for all Atlantic sharks, with an additional allowance of 2 Atlantic sharpnose sharks per person per trip; 4) prohibited all directed (commercial and recreational) fishing for 5 species of sharks (whale, basking, white, sand tiger, and bigeye sand tiger); 5) established a catch-and-release only recreational fishing allowance for white sharks; 6) prohibited filleting of sharks at sea; and 7) reemphasized the requirement for species-specific identification by all vessel owners or operators, dealers, and tournament operators of all sharks landed.

The Shark Evaluation Workshop was not reconvened in 1995 and 1997, because the elapsed time of new regulatory measures and the amount of new information collected in one year were not sufficient to warrant a full new evaluation each year. However, an annual report was prepared to represent the 1995 and 1997 evaluations required by the FMP (SB-IV-40 and SB-IV-32); these were updates to the Workshop Reports prepared in 1994 (SB-IV-39) and 1996 (SB-IV-31), respectively.

A third meeting of the SEW was held June 22-26, 1998 at the Southeast Fisheries Science Center in Panama City, FL. The objectives of the workshop were to review the additional data that has accumulated since the implementation of the FMP and to evaluate changes in status of the shark Large Coastal Group.

1. TRENDS IN ABUNDANCE

Numerous catch rate series for sharks were examined: a total of 76 time series of CPUE data were considered for evaluation (Appendix Table 1). The primary differences between the series presented in this document compared with those of the 1996 SEW are:

For the shark observer time series (SHARK Observer), data for 1996 and 1997 were added and indices for 1994-97 inclusive were aggregated over areas and recalculated for aggregated large coastals, sandbar, blacktip and tiger sharks based on information in SB-IV-2;

For the North Carolina time series (NC # and NC KG), the years 1990 onwards were excluded because the catch rates were expressed in terms of catch per trip and trip limits were implemented in 1990 resulting in many of the largest vessels in the fleet exiting the fishery;

For the Virginia longline survey (Virginia LL, all species and species groups), sample sizes for the years 1974-79 inclusive and 1982-89 inclusive were extremely small so these had previously been aggregated and assigned to the years 1976 and 1986 respectively (with no entries for the other years). It was determined that this approach could bias annual trends in abundance so the previously aggregated years were disaggregated and reported on an annual basis. Values in Appendix Table 1 with the CV reported as 1.0 represent very small sample sizes and were excluded from assessment runs;

For the Large Pelagic Survey (LPS), previous time series for sandbar and dusky sharks were omitted based on evidence of serious problems with species misidentification. Instead, a new aggregated large coastal index was created using GLM analysis and added to the series analyzed. Previous series for hammerhead, blue and mako sharks were retained and updated by adding two more years of data and re-running GLM analyses;

An additional two years of data were added to each of the pelagic logbook series (pelagic logbook), and GLM analyses were re-run resulting in changes to the absolute numbers tabulated (although the historic trends generally remained similar) for each series (aggregated large coastals, sandbar, blacktip, dusky, night, silky, hammerhead, tiger, aggregated pelagics, blue, mako, thresher, and oceanic whitetip sharks);

The Marine Recreational Fisheries Statistics Survey (MRFSS) data for Texas headboats (MRFSS,HBOAT,TX) was split into two separate time series to reflect the fact that bag limits for recreational fisheries came into existence in 1993. The series was updated to 1997;

Two more years of data (1996 and 1998) were added to the NMFS longline survey conducted out of the northeast region (NMFS LL NE). These surveys were conducted at the same time of year (spring) as the 1989 and 1991 surveys, although there were some changes in gear between the two pairs of years. The 1986 survey was conducted in the summer and is placed in parentheses in the table because it is not believed to be comparable to the later years. Nominal indices of CPUE were added to the table for additional individual species commonly caught in the surveys (sandbar, blacktip, dusky, scalloped hammerhead, tiger, and sharpnose sharks);

Several new series of fishery-independent data were created from the NMFS longline survey conducted out of the southeast region (NMFS LL SE), including an aggregate large coastal index and individual indices for sandbar, blacktip and tiger sharks. This survey has now been conducted for three consecutive years (1995-97) using a standardized sampling design;

A new time series based on the Oregon II groundfish survey data was created for aggregate small coastals; however, since sharpnose sharks dominate the shark bycatch, this index essentially mirrors the existing sharpnose shark index;

The remaining series were not updated over those reported in the 1996 SEW.

Of the 76 time series, 47 include data for the recent time period since implementation of the FMP (1993-97). The recent aggregated large coastal, sandbar and blacktip series are examined in more detail in Section 4.1.a. For dusky shark, four indices spanned the recent period and none demonstrated an increasing tendency. For the remainder of the species (i.e., tiger, sand tiger, night, silky, hammerhead, scalloped hammerhead, aggregate pelagics, blue, mako, thresher, oceanic whitetip, aggregate small coastals, sharpnose and bonnethead sharks), there was little if any indication of a recent increasing trend for any series, with the possible exception of one or two series for blue shark and one for oceanic whitetip shark.

Of the 76 time series, 6 are expressed in units of biomass and the rest in units of numbers; thus, most of the subsequent analyses were restricted to the series using numbers. All relevant numbers-based series were used in assessment analyses: 17 series for aggregated large coastal species; 8 for sandbar sharks alone; and 7 for blacktip alone (the biomass index from the Gulf reeffish logbooks was considered along with the indices based on numbers because it was believed that average size had not changed markedly over the duration of the series and because the fishery on which this index is based occurs in the same area as the center of concentration of blacktip sharks). Assessments for other individual large coastal species, pelagic and small coastal categories (represented by a total of 40 time series) were not conducted due to time constraints. The available large coastal CPUE series were of different quantity and quality; most were nominal (aggregated averages from localized fishing operations). However, others were based on analyses designed to adjust for area, season, and fishing practices for set-by-set catch and effort from fishing operations. Of these, two series covered a broad geographical area: the Pelagic Longline Logbook series provided information for a wide area of the western Atlantic large coastal shark fishery, and the Marine Recreational Fishery Statistics Survey (MRFSS) provided information across the spectrum of recreational fisheries off the coastal United States including the Gulf of Mexico and Atlantic. The index data are given in Figures 1.1-1.3 and Appendix 1.

As indicated, the available catch rate information represents a mixture of data time series. Some of these time series are based on analyses designed to adjust the catch rates for spatio-temporal fishing strategies not related to shark abundance (SB-III-17). Other time series data sets are highly nominal sets of information and might be highly influenced by factors other than shark relative abundance patterns. In particular, there was concern about nominal observations from shark tournaments. The data were not standardized and appear to be clustered in the early years. Therefore, they may have a disproportionate influence on trend estimates. It is believed that more detailed analyses of the more nominal time series would help to reduce the uncertainty about the use of these data sets for indicators of shark abundance patterns.

The U.S. Atlantic fisheries landings of sharks have been regulated for only a few years. Since the expected annual rates of change in shark abundance are low and since measures of stock abundance are uncertain, it is unlikely that short-term changes in abundance can be detected with precision. For example, even with reasonably precise indices of abundance having CVs of 20%, it would be necessary for the stock to halve or double in order to detect a change with high probability. Hence, it may not be possible to detect year to year changes in abundance.

The large coastal, sandbar and blacktip indices used in further analyses are plotted in Figures 1.1-1.3.

2. BIOLOGICAL PARAMETERS

2.1. Vital Rates

To assess biological productivity of key species in the large coastal fishery, the Workshop focused on improving and extending the demographic models developed in the 1994 and 1996 Shark Evaluation Workshops. The purpose of the demographic runs was to develop a range and estimate a mean for ***r***, the intrinsic rate of increase, for several key species of large coastal sharks in the western Atlantic, based on the best available biological information. Of special relevance were the values derived for the sandbar and blacktip sharks, since these two species comprise approximately 80% of the landings. With a range of ***r*** values, stock rebuilding schedules can be examined for their biological realism based on current levels of *F*, target goals for the stock, and rebuilding time frames. Estimates of ***r*** are also required as prior probabilities in Bayesian analyses.

The 1996 Workshop had recognized the need for incorporating some of the uncertainty and variability associated with vital rates by using a stochastic framework. Subsequent to the 1996 meeting a stochastic analysis was conducted for sandbar sharks (Appendix 2 in SB-IV-31). An additional analysis evaluated the effects of uncertainty in estimates of reproductive output and survival rates of four species of large coastal sharks: the sandbar, blacktip, dusky, and lemon sharks (SB-IV-10). In this analysis, age-specific survivorship for early ages was obtained from a life history method relating weight to natural mortality; for later ages survivorship was randomly selected from a distribution of survival rates obtained through one or two additional life history methods. It was assumed that all estimates of survivorship were equally probable. Age-specific reproductive rate was calculated by randomly choosing the number of pups per female from a normal distribution with a given mean and standard deviation for each species and further dividing by two to account for a biennial cycle and by two again to consider a sex ratio of offspring at birth of 1:1. It was also assumed that all mature females were reproductively active in any given year regardless of their age (thus no reproductive senility). Both age at maturity and longevity were obtained from published studies and held constant. For the stochastic simulations the effective longevity was chosen with the consideration that less than 1% of females be alive at the beginning of their last year of life.

Table 1. *Estimates of mean, maximum, and minimum intrinsic rates of increase for four representative species of large coastal sharks and for the large coastal shark group.*

Estimate	Large Coastal Group	Sandbar	Blacktip	Dusky	Lemon
Mean	0.029	0.034	0.022	0.028	0.056
Upper bound	0.113	0.117	0.136	0.041	0.058
Lower bound	0.018	0.022	0.009	0.0007	0.054
Percent of catches		26	53	4.6	16.4*

* Includes all other large coastal species

Table 1 summarizes the estimates of intrinsic rate of increase that were considered more likely by the Committee. The upper bound represents the absolute biological upper limit of the ability of each species to increase stock size assuming geometric growth. In theory, the intrinsic rate when population sizes are very small corresponds to the r value used in production model analysis. Therefore, it was felt that this value should be closer to the upper bound of the ranges in Table 1. Thus, the upper bounds were used as prior means of r for subsequent Bayesian analysis. The mean, upper, and lower bound estimates for the four species come from a variety of sources: Table 2 in the 1996 SEW report (SB-IV-31), Table 1 in document SB-III-25, and Table 1 in document SB-IV-10. Estimates for the large coastal shark group were calculated as the mean of the corresponding estimates for each species weighted by their average contribution to the commercial and recreational catches. In all, both deterministic and stochastic predictions reinforce the conclusion that our present knowledge indicates that maximum annual intrinsic rates of increase are unlikely to exceed 12% for sandbar sharks and the large coastal assemblage and 14% for blacktip sharks. Additionally, dusky sharks are perceived to have very little potential, i.e., the upper bound of r is small. Thus, this species is more likely to be susceptible to overexploitation than some of the others.

2.2. Life Stage Modeling, Minimum Size Limits, and Nursery Areas

Evidence indicating that juvenile and immature life stages of sandbar sharks are the most sensitive to changes in survivorship (SB-IV-4 and SB-IV-9) was reviewed. One line of evidence (SB-IV-4) indicated that juveniles (considered to correspond to sharks ~ age 1-6) and subadults (~ age 7-14) were the most sensitive stages. The second line of evidence indicated that large juveniles (considered to correspond to sharks ~ age 4-9) and young adults (~ age 13-18), respectively, were the most sensitive. Minimum size at sexual maturity for female sandbar sharks is approximately 140 cm FL (168 cm TL).

Considering the above information together with life table analyses previously conducted for the sandbar shark (SB-III-20), it was indicated that only low values of $F\sim0.1$ should be applied to sharks age 8-10+. Also, a yield per recruit analysis (SB-III-25) showed that values of $F<0.1$ and a late age of entry in the fishery in excess of the age of maturity may be most beneficial in terms of yield in weight per recruit. This and the above supported consideration of a minimum size limit of approximately 140 cm FL (168 cm TL) for the sandbar shark.

There was also discussion of the adequacy of minimum size limits vs. time/area closure strategies. A minimum size limit might be a more effective and practical management strategy than time/area closures because the former protect fish regardless of time and location and are easier to implement from an enforcement standpoint. It was also noted that a minimum size limit could effectively remove fishing effort from nearshore areas where juvenile or smaller sandbar sharks are more abundant. This effort would have a large recreational component. It is unclear whether displaced effort would or could move to offshore areas where larger fish predominate without incurring a large bycatch of fish. A minimum size would also provide ancillary protection for other smaller species of sharks that may congregate in nearshore waters, in particular for dusky sharks. It is also recommended differentiating between "ridgeback" and "non-ridgeback" large coastal sharks, and establishing a sandbar shark-based minimum size limit for ridgeback large coastal species as a practical means to separate the sandbar shark-based fishery from the blacktip shark-based fishery for management and enforcement purposes.

A commercial minimum size limit for blacktip sharks is not suggested because of incomplete biological information on life stages at this time and different size/depth segregation patterns from the sandbar shark. It was determined that imposing a commercial size limit on the blacktip shark might result in substantial bycatch of other small sharks and thus increase fishing mortality. A TAC reduction for non-ridgeback large coastal sharks including blacktips was identified as a more reasonable strategy should reductions in F be necessary. There is concern about the general lack of knowledge of the fishery dynamics in the western Gulf of Mexico and about the fact that the blacktip shark fishery seems to be juvenile-based and might thus result in future population declines.

Conversely, a recreational minimum size limit for blacktip sharks was suggested as an effective way to reduce fishing mortality in this species and helping protect the smaller/younger stages. This was thought to be a viable option because the recreational fishery for blacktip sharks catches mostly juveniles and post-release survivorship of blacktips caught on rod and reel appears to be very high. As with the sandbar shark, it was also recommended establishing a blacktip-shark based minimum size limit for all non-ridgeback large coastal shark species to facilitate both regulation and enforcement.

Progress has continued to be made since 1996 to identify pupping and nursery areas and characterize juvenile habitat in the Gulf of Mexico and U.S. Atlantic (SB-IV-6, 7, 13, 15, 24, 28, and 35). Further delineation of nursery areas is available from previous Shark Evaluation Reports and background documentation. For the sandbar and blacktip sharks, these areas lie primarily in inshore waters of the mid-Atlantic (sandbar) and the south Atlantic and Gulf (blacktip). Over-wintering areas for the juveniles, however, are still poorly known at this time.

3. CATCH AND LANDINGS

U.S. Atlantic shark catches increased rapidly during the late 1980's and early 1990's to more than 9,500 mt, but have recently been limited by a suite of regulations including a commercial quota. Because species-specific catches of sharks were not documented until 1994, they are grouped by similar life-history and habitat characteristics for the purpose of management. Most of the recent U.S. catch of sharks for the market is of species grouped as large coastal sharks (e.g., blacktip, sandbar, dusky, spinner sharks, etc.). Some pelagic sharks (e.g., mako, thresher, porbeagle) are also highly valued by U.S. fishers targeting tunas and swordfish.

Estimates of total catch and dead discarded large coastal sharks for the period 1981-1995 were summarized in Table 2 of the 1996 Report of the Shark Evaluation Workshop (SB-IV-31). Estimated catches for 1996 and 1997 were added and presented in Table 2 herein.

U.S. commercial landings of Atlantic Sharks in 1996 and 1997 were compiled based on Northeast Regional general canvass data, Southeast Regional general canvass landings data, and the SEFSC quota monitoring data based on southeastern region permitted shark dealer reports. Landings for 1996 were taken as reported in the 1997 Shark Evaluation Report. For 1997, North Carolina (NC) dogfish landings by gear (used in partitioning NC unclassified sharks by gear) were assumed equal to the average of 1995 and 1996 landings. Landings in southeastern states reported in the general canvass and quota monitoring data files were combined to define the species composition and volume of landings. The quota monitoring data provided a more diverse species listing than the general canvass data, while the general canvass data apportioned a higher volume of shark landings as unclassified. The larger reported landing of a given species in the two data sets was taken as the actual landed volume for that species. The positive difference between the quota monitoring data and the general canvass data was then subtracted from the unclassified sharks category of the general canvass data to maintain the total landings volume equal to that reported in the general canvass data files. For the state of NC, it was believed that some dogfish may have also been assigned to the unclassified sharks category. To adjust for this possibility for the state of NC, the NC unclassified sharks were first apportioned between the large coastal, small coastal, pelagic and dogfish categories based on the reported distribution of landings by species and gear for that state. For states other than NC, the remainder of unclassified shark landings were assigned to the large coastal group unless the harvesting gear was pelagic longline, in which case the landings were assigned to the Pelagic group. The resulting landings estimates for 1996 and 1997 are shown in Table 2 of SB-IV-12.

Commercial Landings and Discards. The U.S. commercial shark fishery is primarily a southern coastal fishery extending from North Carolina to Texas. About 90% of recent U.S. Atlantic Large Coastal shark landings came from the southeastern region. The most sought after species in this fishery are blacktip and sandbar sharks, although others are also taken (SB-III-1).

Table 2. Estimates of Total Landings and Dead Discards for Large Coastal Sharks (numbers of fish in thousands), modified from 1996 Report of the Shark Evaluation Workshop.

Year	Col 1 Commercial Landings	Col 2 Longline Discards	Col 3 Rec. Catches	Col 4 Unre-ported	Col 5 Coastal Discards	Col 6 Total
81	16.2	0.9	265.0			282.1
82	16.2	0.9	413.9			431.0
83	17.5	0.9	746.6			765.0
84	23.9	1.3	254.6			279.8
85	22.2	1.2	366.1			389.6
86	54.0	2.9	426.1	24.9		508.0
87	104.7	9.7	314.4	70.3		499.0
88	274.6	11.4	300.6	113.3		699.9
89	351.0	10.5	221.1	96.3		678.8
90	267.5	8.0	213.2	52.1		540.8
91	200.2	7.5	293.3	11.3		512.3
92	215.2	20.9	304.9			541.1
93	169.4	7.3	249.0		17.6	443.3
94	228.0	8.8	160.9		22.8	420.5
95	222.4	6.1	183.4		22.2	434.1
96	164.5	5.7	184.5		16.4	371.1
97	98.4	5.6	161.9		9.8	275.7

Column 1, commercial landings - These data are the landings reported under the established NMFS cooperative statistics program. (See document SB-III-6 for a description of this data collection program.) The data are collected in landed or dressed weight. Various sources of weight per fish estimates were used to convert pounds to numbers of fish. For the period 1981 through 1985, a generic factor of 45 pounds dressed weight per fish was used. For 1986 through 1991, an average weight for all species was used. These averages are the ones that were used in the 1992 assessment. For 1992 and 1993, average weights for coastal species observed in longline catches were used in document SB-III-6, but the group felt that these weights were too high to apply to fish caught nearer shore in the directed large coastal fishery. Therefore, a weight of 40 pounds per fish was used for these two years. For 1994 through 1997, predicted weights from lengths based on the observer program (Branstetter and Burgess 1997) and data from the pelagic longline database were used.

Column 2, pelagic longline discards - The data for this column are from the analyses of the discards by pelagic longline vessels (see document SB-III-4). The estimates prior to 1987 are calculated using the average ratio of the discards to commercial landings for the data for 1987 through 1992 (discards as a fraction of combined landings and discards averaged 5.12% over this period). A fraction of 5.12% was also assumed for the 1996 value since data to support a new estimate for 1996 are not yet available.

Column 3, recreational harvest - These data are reproduced from document SB-III-5 and include estimated catches from the NMFS MRFSS, headboat and charter boat surveys and the Texas Parks and Wildlife recreational creel survey. The estimate for 1996 also included catches from the same three sources (described below).

Column 4, unreported catches - These data are from a single source, which owned a fleet of vessels that fished in the Gulf of Mexico and off the coast of North Carolina. The estimate for 1988 was determined from company landings records. The estimates for other years were prorated based on the 1988 landings record and financial statements indexing income from shark fishing (SB-III-30). The Working Group did not have any way of determining the amount, if any, of these catches that were included. Therefore, the Working Group made the assumption that none of the catches were included and kept these data separate, listing them as unreported. The implicit assumption in doing this is that the landings were off-loaded in Alabama docks, but not sold to Alabama dealers.

Column 5, discards by coastal fishery - These data are from the Gulf and South Atlantic Fisheries Development Foundation/University of Florida observer program (SB-III-1) and show that slightly more than 10% of large coastal species were discarded by the directed fishery in 1994 and 1995. The calculated percentages for 1994 and 1995 were averaged and applied to the recorded landings for 1993 to give an estimate of the discards in 1993. A 10% discard fraction was also assumed for 1996. The discarded species are non-marketable animals that are included in the large coastal management unit.

Column 6, total - The numbers in this column are the sum of columns 1-5.

As reported to the 1996 Shark Evaluation Workshop, information from observer sampling on board directed effort shark vessels (Branstetter and Burgess 1997) was summarized to obtain information on the average size of sharks harvested by the commercial fleet. The measured average size of the observed component of the large coastal shark catch in 1996 was 20.34 kg (44.8 lb), dressed, based on a sample of 264 specimens weighed, while in 1997 the average size of the observed component of the large coastal shark catch was 19.75 kg (43.5 lb), dressed, based on a sample of 224 specimens weighed. These average sizes are inconsistent with the average weights predicted from lengths of measured fish from the same survey program (see SB-IV-12). Applying weight-length regressions summarized in SB-III-5 results in fork length predicted average weights of 14.0 kg (30.86 lb) and 13.72 kg (30.24 lb), dressed, from 2,844 and 5,345 fish fork lengths in 1996 and 1997, respectively. Differences in predicted and observed sample weights likely result from the opportunistic nature of weight measures made during the observer program (K. Johns, Univ. Florida, personal communication). Over the period 1994-1997, the number of shark weight observations has diminished (SB-IV-12). For the estimates in Table 2, it is assumed that average weights predicted by fork length (SB-IV-12) are a closer approximation to the actual dressed weights of sharks caught in the commercial fishery. The observer program provides needed information on both the sizes of fish in the catch and the discards from that fishery.

In 1996 the estimated U.S. commercial landings of Atlantic large coastal sharks were 2,387 mt dressed weight (about 113,300 - 164,500 fish, depending on average size data) and in 1997 the estimated U.S. commercial landings of these sharks were 1,418 mt (about 68,400 - 98,400 fish depending on average size assumptions). These levels represent a reduction from peak recorded commercial landings (about 4,600 mt, approximately 350,000 fish in 1989; SB-III-6) of this grouping of sharks). Commercial catches of large coastals in numbers in 1997 are estimated to be less than 50% of those in 1995 (Table 2).

Recreational Harvest Estimates. Recreational fishing for sharks also results in significant harvests of large coastal (and other) shark species (SB-III-5). Recreational harvests of sharks occur all along the U.S. Atlantic and Gulf of Mexico coasts. Recreational harvests of the large coastal grouping of sharks in 1995 were estimated to be on the order of 183,000 fish (about 780mt; SB-III-5). The estimated harvest for 1996 (from the same sources as SB-III-5 and as reported in the 1997 Shark Evaluation Report) by the recreational sector was about 184,500 fish, essentially the same as estimated for 1995. For 1997 the recreational harvest of large coastal sharks was estimated to be about 162,000 fish. The 1997 estimated harvest assumes that the catches of large coastal sharks made by Texas anglers in 1997 were the same as in 1996, since Texas Parks and Wildlife Department Recreational Fishing Survey catch estimates are not yet available. These recent estimates are lower than the mid-1980s level of about 375,000 fish (about 3,000 mt). About 23,000 unidentified sharks (about 45 mt) were estimated to have been harvested in 1995 and about 27,000 in 1996 and about 15,000 in 1997 by the recreational fishery, some of which might have been from the Large Coastal grouping. Recreational catches in numbers are estimated to be 88% of those in 1995 (Table 2). The 1996 and 1997 recreational catches in numbers were greater than those from the commercial sector (Table 2).

Bycatch and Discard of Sharks. As reported in the 1996 Shark Evaluation document, bycatch of sharks is also known to occur in trawl, set-net and hook and line fisheries. For instance, in the Gulf of Mexico, shark bycatch by the U.S. shrimp trawl fleet consists mainly of sharks too small to be highly valued in the commercial market (SB-III-23). Bycatch of sharks in trawl and other fisheries outside of the Gulf of Mexico also likely occurs with regularity. Pelagic fisheries targeting swordfish and tunas can, at times have shark bycatches which exceed the targeted species catch. In the U.S. longline and drift gillnet fisheries, logbook and scientific observer reports indicate shark bycatch varies with target species (e.g., yellowfin tuna, bigeye tuna or swordfish), gear characteristics and fishing season. Estimates of the annual dead discarded tonnage of large coastal sharks by these U.S. fisheries between 1987 and 1995 range from about 140-875 mt (approximately 6,000-21,000 fish; SB-III-4). Estimates for 1996 were provided in Cramer et.al. (1997) and for 1997 in Cramer and Adams (SB-IV-31). For 1996 and 1997, approximately 5,600-5,700 large coastal sharks per year were estimated to have been discarded dead by these fleets. Observer data collected from the directed shark fishery (Branstetter and Burgess 1997) indicate the landed catch of large coastal sharks from the fishery represents about 90% of the total mortality attributable to the large coastal grouping harvested by the fishery.

Historical estimates of shark harvest are more uncertain than those from the more recent period. This is attributable to the practice of finning, and some unknown degree of underreporting. The estimates of Table 3, although not based on any quantitative measures of these features, are proposed as a catch series for use in evaluating the sensitivity of the assessment models applied to changes in catch history.

Table 3. Modifications to estimates of Total Landings and Dead Discards for Large Coastal Sharks (numbers of fish in thousands), to evaluate the sensitivity of assessment models using catch data.. Modifications from Table 2 are shown in italics.

Year	Col 1 Commercial Landings	Col 2 Longline Discards	Col 3 Rec. Catches	Col 4 Unre-ported	Col 5 Coastal Discards	Col 6 Total
81	*24.3*	*10.0*	265.0			*299.3*
82	*24.3*	*10.0*	413.9			*448.2*
83	*26.2*	*10.0*	*324.6*			*360.8*
84	*35.8*	*10.0*	254.6			*300.4*
85	*33.3*	*10.0*	366.1			*409.4*
86	*108.0*	*10.0*	426.1	24.9		*603.8*
87	*209.4*	9.7	314.4	70.3		*499.0*
88	*549.2*	11.4	300.6	113.3		*974.5*
89	*702.0*	10.5	221.1	96.3		*1029.9*
90	*535.0*	8.0	213.2	52.1		*808.3*
91	*400.4*	7.5	293.3	11.3		*712.5*
92	*430.4*	20.9	304.9			*756.2*
93	*254.1*	7.3	249.0		*25.4*	*535.8*
94	228.0	8.8	160.9		22.8	420.5
95	222.4	6.1	183.4		22.2	434.1
96	164.5	5.7	184.5		16.4	371.1
97	98.4	5.6	161.9		9.8	275.7

Columns as above, except for column 1, during the period 1981-1985, commercial catches were assumed underreported by 50% and thus the values in the base catch table were multiplied by 1.5. For the period 1986-1992, commercial catches were assumed to be underreported by 100% and thus the values in the base catch table were multiplied by 2. For 1993, the catches made prior to the mid-year implementation of the FMP were assumed underreported by 100% and thus the values in the base catch table were multiplied by 1.5.

Column 2, For the period 1981-1986, longline dead discards were assumed to equal 10,000 fish per year.

Column 3, The 1983 recreational catch estimate was assumed to be the geometric mean value of the 1982 and 1984 estimates, although there is no obvious statistical or sampling theoretical reason to consider the 1993 catch estimate less accurate than the neighboring years estimates.

Species-Specific Catch Histories. For the purpose of development of species-specific assessments, estimates of the historical catch time series for blacktip and sandbar sharks were prepared based on estimated area and gear specific landings by year. Estimated catches of blacktip (Table 4) and sandbar (Table 5) sharks were based on the proportional allocation of commercial landings of unclassified sharks by gear type and region defined in SB-IV-31 for the period 1986-1995 and using the species breakouts defined in SB-IV-12 for 1996 and 1997. Unclassified sharks in 1996 and 1997 attributed to the large coastal grouping were proportionally allocated to sandbar and blacktip sharks, respectively, based on the species-specific landings identified in SB-IV-12. Unreported landings were based on the assumed proportions of the values reported in Table 1 of SB-IV-12: 75% blacktip and 25% sandbar for the period 1986-1987, and 50% blacktip, 50% sandbar for the period 1988-1991. Species-specific recreational catches are as reported in SB-III-7 and SB-IV-12. Levels of dead discarded blacktip and sandbar sharks are assumed to be negligible for U.S. pelagic longline fisheries. Average weights for these species are taken as predicted weights from fork length measures from Table 5 of SB-IV-12 (Rev) for the period 1994-1997. Prior to 1994, values assumed are indicated. Estimates of numbers of sharks caught and landed by the directed commercial fleet are taken as estimates of lb (dressed) landed/average wt (dressed, lb). Alternative catch scenarios for blacktip and sandbar used the same logic as for the large coastals in Table 3.

***Table 4.** Estimates of the annual catches of blacktip sharks based on area-gear definitions described in SB-IV-31.*

Year	Blacktip lb landed	Average Wt	lb landed/ Ave Wt	Recreational Harvest	Rec+Com	Unreported	Mexico small fish	Total
1986	1213040	20.5	59173	162403	221576	18675	15642	255893
1987	1463544	20.5	71392	129552	200944	52725	22346	276015
1988	3300321	20.5	160991	139809	300800	56650	29050	386500
1989	3832421	20.5	186947	111363	298310	48150	35754	382214
1990	2052287	20.5	100112	94135	194247	26050	42458	262755
1991	2744292	20.5	133868	150794	284662	5650	49161	339473
1992	3610218	20.5	176108	157659	333767		55865	389632
1993	3086965	20.5	150584	109054	259638		62569	322207
1994	3829364	20.0	191468	66106	257574		62569	320143
1995	2915797	20.9	139512	67046	206558		62569	269127
1996	2121714	22.3	95144	78010	173154		62569	235723
1997	1709694	22.6	75650	68284	143934		62569	206503

***Table 5.** Estimates of the annual catches of sandbar sharks based on area-gear definitions described in SB-IV-31.*

Year	Sandbar lb landed	Average Wt	lb landed/ Ave wt	Recreational Harvest	Rec+Com	Unreported	Total
1986	796509	35.9	22187	123661	145848	6225	152073
1987	2285644	35.9	63667	32551	96218	17575	113793
1988	2737938	35.9	76266	64792	141058	56650	197708
1989	4215657	35.9	117428	27415	144843	48150	192993
1990	4026470	35.9	112158	58811	170969	26050	197019
1991	3292594	35.9	91716	36794	128510	5650	134160
1992	3470449	35.9	96671	36294	132965		132965
1993	2483235	35.9	69171	26607	95778		95778
1994	4691470	35.4	132527	14973	147500		147500
1995	3012065	36.4	82749	24869	107618		107618
1996	2004759	31.3	64050	35180	99230		99230
1997	982100	30.7	31990	40929	72919		72919

Mexican Catches. The additional source of mortality resulting from catches of Large Coastal sharks in Mexican fisheries was investigated. Results from an intensive monitoring project of the artisanal shark fishery in the Mexican Gulf conducted from November 1993 to December 1994 showed that this multispecific fishery is dominated by Atlantic sharpnose, bonnethead, and blacktip sharks, which account for 46%, 15%, and 11% of the landings by number, respectively (SB-IV-8). In contrast, sandbar sharks only represented 0.6% of the landings numerically. These results are illustrative because the artisanal coastal fishery is believed to account for about 80% of the total shark production in the Mexican Gulf.

Since blacktip sharks are known to migrate from the western U.S. Gulf into the Mexican Gulf, where they make up an important part of the fishery, an attempt was made to estimate the loss of blacktip sharks from the U.S. harvestable stock into Mexican waters. An estimate of about 62,569 fish was obtained based on the following considerations and assumptions: the annual landings for the "cazon" category (consisting of sharks less than 1.5 m in length) were 4,685 mt (1995 estimate), blacktip sharks make up 11% of the total Mexican catches in the Gulf (or about 515.35 mt), the two western-most states (Tamaulipas and Veracruz) account for 79% of blacktip landings, the average weight of "cazones" is 3 kg (6.7 lb), and 100% of the Mexican catches of blacktip sharks in those two states are animals which have migrated from the northwestern U.S. Gulf to Mexico during the six fall and winter months of the year (SB-IV-8, 36, and 38). Since the estimate of 62,569 related to 1993, a Mexican catch scenario was created by increasing catches linearly from 25% of 62,569 in 1986 to 100% of 62,569 in 1993; with 1994-97 being set equal to 1993 (Table 4). This estimate was incorporated into the blacktip population model analyses and in Table 4. Efforts should continue to obtain better information on Mexican catches, the proportion of large vs. small coastal sharks, and the rates of movement of large coastal sharks, particularly blacktip and sandbar sharks, from the U.S. to Mexico.

4. POPULATION MODELING

An attempt was made to integrate several population models and approaches. Thus, results from demographic methods (SB-IV-9, 10 and SB-III-20, 25) and catch rates (SB-IV- 1, 2, 3, 5, 6, 11, 13, 15, 16, 18, 23, 28, 29 and 30) were evaluated as input in a production model within a Bayesian framework (SB-IV-21, 26, 27, 41).

The demographic or life table approach uses estimates of vital rates to determine the innate capacity that a population has to increase assuming geometric growth. This approach thus assumes closed populations and no density-dependent compensatory mechanisms. In addition, the method does not allow estimation of actual exploitation rates or absolute population levels.

The catch rate data utilizes the frequency of catch per unit of sampling (or fishing effort) as an indicator of relative abundance. As noted in Section 2, in some cases these data have been standardized to eliminate signals that are unrelated to abundance. However, that could not be done in all cases. Nevertheless, in aggregate the catch rates can be used as guidance to recent trends in abundance.

The production modeling approach uses information on the catch history and indices of abundance to determine population levels, relative population levels, fishing mortality history and benchmarks such as Maximum Sustainable Yield (or Catch) and fishing mortality rates that achieve the benchmarks. Disadvantages in the method are that it assumes a closed population (no net migration rate), that population parameters are stationary, and that the population responds instantaneously to the changes in magnitude of fishing. Weaknesses include that the model parameters are defined in terms of maximum intrinsic rate of increase and carrying capacity and not in terms of natural mortality and recruitment. Also, model fits are often sensitive to short time series of catch and CPUE, especially when there are lags between birth and maturity and the data do not span the period where maximum production occurs.

Fishery management involves making regulatory decisions in the presence of uncertainty. Bayesian statistical analysis is a tool that allows stock assessments to provide quantitative support required by managers for decisionmaking when faced with uncertainty (see NRC, 1998 and references therein). The Bayesian approach to stock assessment uses a probabilistic framework for assessing the biological status of fishery resources and evaluating the implications of alternative management strategies (SB-IV-21, 26, 27). The essence of the Bayesian approach lies in replacing unknown parameters by known probability distributions for those parameters observed previously, which are generally referred to as *priors*. The general framework for Bayesian stock assessment and decision analysis includes: 1) identification of alternative management procedures; 2) specification of indices of policy performance; 3) specification of alternative hypotheses; 4) determination of the relative weight of the evidence supporting each alternative hypothesis; 5) evaluation of the distribution and expected value of each management performance measure for each alternative management procedure; and 6) presentation of results to decision makers.

The main advantages of the Bayesian approach applied this year to shark stock assessment are that it deals directly with uncertainty and it allows integration of demographic (vital rate) information into the production model through prior distributions on r. The model applied is still a surplus production model, but it has the added advantage of incorporating population biological information.

Beyond the pros and cons of the modeling approaches themselves, they all require inputs that should represent what they are supposed to represent, i.e., CPUE, average weight, effort and catch histories should be unbiased measures of their true quantities. While some models are robust to errors in some inputs, the models themselves cannot make up entirely for lack of accuracy and precision in the basic data.

4.1. Model Applications

4.1.a. Trends in Catch Rates

An analysis of catch rate data may be considered a population modeling exercise from which we can look for patterns in trends of abundance. An advantage of this approach is that given that catch rate data are indicators of relative abundance, then the analysis makes no assumptions about catch rates being obtained from closed populations or not. In other words, the rate can be interpreted as an index of abundance within an area/region without inferring whether dynamics in the rate are caused by mortality, migration or growth. The disadvantages, of course, are that one cannot directly infer management quantities about the catch such as MSY. Also, the overarching assumption in using these data is that the data truly represent an index of abundance. This is also true when using catch rates in other model fitting procedures, such as production modeling.

Table 6. *Recent (1993-97 and 1990-97) trends in catch rates. Slopes and standard deviations (SD's) of the slopes are expressed relative to the mean of the data points (n) in the slope calculation. Slopes that are significantly different from zero at a 0.1 probability level are marked with an *.*

		1993-97 Data			1990-97 Data	
Index	n	slope	SD	n	slope	SD
Large Coastal Sharks						
Shark Observer	4	0.1367*	0.0391	4	0.1367*	0.0391
Virginia LL	4	0.0975	0.1005	7	0.1251*	0.0436
LPS	5	0.1753	0.1488	8	-0.0969	0.0867
Charter Boat	3	0.0470	0.0373	6	-0.0095	0.0241
Pelagic Log	5	-0.2160*	0.0628	8	-0.1821*	0.0203
Late Rec Surveys	5	-0.1163*	0.0515	5	-0.1163*	0.0515
NMFS LL SE	3	-0.2870	0.3999	3	-0.2870	0.3999
Early Rec Surveys	–	----	----	3	0.1563*	0.0063
NMFS LL NE	–	----	----	3	0.0161	0.2057
Sandbar						
Virginia LL	4	0.1051	0.0696	7	0.1876*	0.0518
Pelagic Logs	4	0.1995	0.1584	4	0.1995	0.1584
Late Rec Surveys	5	0.1347	0.0771	5	0.1347	0.0771
NMFS LL SE	3	-0.0101	0.3082	3	-0.0101	0.3082
Shark Observer	4	0.3654*	0.0940	4	0.3654*	0.0940
Early Rec Surveys	–	----	----	3	-0.2917	0.2165
NMFS LL NE	–	----	----	3	0.1010	0.2348
Blacktip						
Pelagic Logs	5	-0.1920*	0.0445	6	-0.1385*	0.0387
Late Rec Surveys	5	-0.1277	0.0662	5	-0.1277	0.0662
Shark Observer	4	-0.0856	0.3799	4	-0.0856	0.3799
NMFS LL SE	3	0.0518	0.2945	3	0.0518	0.2945
Gulf Reef Logs	5	0.3462*	0.1252	5	0.3462*	0.1252
Early Rec Surveys	–	----	----	3	0.2285*	0.0272
NMFS LL NE	–	----	----	3	-0.0667	0.1734

Trend analysis of recent catch rate data is presented in Table 6. For the period since 1993 (1993-97 since the advent of the FMP) for large coastals: 3 of the 7 indices exhibit negative slopes (2 of which are significantly different from zero) and 4 indicate positive slopes (1 of which is significantly different from zero). The largest annual rate of increase from these indices during this period was 17%, while the largest decrease was 29%.

For sandbar during the period 1993-97: 4 of the 5 indices exhibit positive slopes (1 of which is significantly different from zero) and only 1 showed a negative slope (which was not significantly different from zero). The largest annual rate of increase from these indices during this period was 37%, while the only one showing decrease, decreased at 1% annually.

For blacktip during the period 1993-97: 2 of the 5 indices exhibit positive slopes and 3 showed negative slopes. One of the positive slope indices and one of the negative slope indices were significantly different from zero. The annual rate of change from these indices ranged from 35% to –19%.

Another procedure was used for examining trends in the data which was similar to that conducted in previous years; i.e., to apply a generalized linear model to the available data to scale each independent time series into a single series representing an average species or species group catch rate category. The model was applied to data transformed by natural logarithms controlled for source of data. The annual CPUE values (both nominal and standardized) were weighted in the analysis by the inverse of the precision of the value (i.e., the inverse of the coefficient of variation). In cases where only nominal information was available, or where no measure of uncertainty in the annual CPUE series was available, a coefficient of variation of 100% (weight of 1.0) was assumed. Results (Fig. 4.1) have large variability such that one cannot show significant differences in rates between any two years. Nevertheless, the mean estimates for large coastals indicate a slowing of the decrease in recent years; whereas, the means for sandbars show stabilization and perhaps an increase in recent years. Variability in the blacktip results dominates any signal from this analysis.

4.1.b. Demographic Method

Using the demographic approach in the case of Large Coastal sharks, one argues that the observed vital rates are a manifestation of the dynamics when density-dependence has already occurred. Then by comparing derived intrinsic rates of increase (r) to fishing mortality rates (Fs) derived from the catch data, and also to the various rates of increase required by different stock rebuilding schedules, the appropriateness of management measures can be assessed. In simple terms, if $F>r$ the stock will not be able to rebuild.

In fact, intrinsic rates derived from demographic methods are closely related to production models. Fishery science literature often recommends an F equal to one half of the maximum r for parabolic production curves in order to achieve MSY for the stock. This corresponds to a production model curve that is parabolic (with an exponent of 2). However, it is argued that production curves of species with low production capacity should exhibit maximums which occur closer to the carrying capacity than to the origin (SB-IV-10), i.e., with exponents greater than 2. This would imply that maximum productivity occurs at larger stock sizes than with an exponent of 2. This also implies that the F which maximizes equilibrium yield occurs at a higher proportion of r than one-half. Then there would be proportionally less flexibility between the F at maximum production and an F greater than the value of r_{max}, at which the population cannot persist.

One should be aware that the above arguments no longer apply if the fishing mortality rates are using an "open" stock scenario, i.e., where there is migration of the stock available to the fishery (note this migration includes migration of fish and/or fishers). The estimated F is for the known fishery, whereas the r is for the whole resource.

The examination of the parameters in Section 2.1 indicated maximum annual intrinsic rates of increase of about 12-14% for sandbar and blacktip. Therefore, it is unlikely that fishing mortality rates in excess of 12-14% for sandbar and blacktip are sustainable.

4.1.c. Production Model in A Bayesian Framework

Production modeling was conducted previously and reported on in the 1996 SEW Report. The production models integrated catch rate information with the catches into a population framework. However, the demographic data were not integrated at that time. Instead, results of the two types of analyses were compared. This was difficult in that some parameters were not directly equated between the two methods. In this SEW, analyses were conducted which allowed integration of the demographic information into the production model analyses through a Bayesian framework (as in SB-IV-21, SB-IV-26, SB-IV-27).

Since most of the CPUE series and catches were in numbers of fish rather than in biomass or yield in weight the production modeling method was used to estimate numbers of fish rather than biomass. Also, the production model fits used in the following scenarios assumed a parabolic model wherein the maximum net production in numbers occurs at half of equilibrium carrying capacity and the fishing rate that produces it occurs at half of the maximum intrinsic rate of increase (maximum r). As noted earlier, this assumption may not be appropriate for long-lived sharks (SB-III-21); maximum production may occur at more than half of carrying capacity and the F may occur at more than half of the maximum r.

A stock production model was fitted to the CPUE data presented in Section 1, and prior information on the parameter for the intrinsic rate of increase, r (presented in Section 2), and on the average catch between 1975 and 1981 (since catch rate data extend back to 1975 but data on total catch only date back to 1981) were incorporated into the model. Production model fits were done on the Large Coastal group as an aggregate, on the sandbar shark individually, and on the blacktip shark individually. In each case, two scenarios were considered: one based on the baseline catch history presented in Table 3 and the other based on the same catch history adjusted for underreporting (Table 4).

Detailed results from the analyses based on the six scenarios are summarized in Appendix 2. Each scenario shows the mean of the posterior distribution for input parameters r and carrying capacity, K, estimated by combining the priors and the stock assessment data using Bayes theorem. It was assumed that the probability density function for r was lognormal. The estimated average catch for 1975-1980 (*C1975-80*), MSY, stock size at the beginning of 1975 and 1998 (*N(75)* and *N(98)*), stock size at the beginning of 1998 as a proportion of *K* (*N(98)/K*) and of the stock size at the beginning of 1975 (*N(98)/N(75)*), and catch in 1997 as a proportion of maximum sustainable yield or catch (*C(97)/MSC*) are also summarized for each scenario. A measure of the precision of the estimates (the coefficient of variation) is also given. The annual variation in estimated stock size (*N*), stock size as a proportion of *K* (*N/K*) and of the stock size at MSY (*N/Nmsy*), fishing mortality rate (*F*), and *F* as a proportion of the fishing mortality rate producing MSY (*F/Fmsy*) are also provided for the period 1974-1997 (Tables 7, 8, and 9). The most relevant results for each scenario are summarized next. Fits to the indices under each modeling scenario are shown in Figures 4.2-4.7, corresponding to each of the following six scenarios.

Scenario 1: *Large Coastal sharks, baseline catch.* A total of 17 CPUE series were used (see Appendix 2). Each series was weighted by its inverse variance. Model fits to the indices are shown in Figure 4.2. Results indicated that the mean posterior for *r* was 0.067 (the mean prior for *r* was 0.113); the maximum sustainable catch in numbers (MSC) was 149,063 fish; stock size had continuously declined from 8,927,100 fish in 1974 to an estimated 1,385,000 fish in 1998; the stock size in 1998 was estimated to be about 15% of *K*; the catch in 1997 was about 2.2 times that which would produce MSC; and the 1997 fishing mortality rate (0.182) was over 6 times higher than that which would produce MSY (*F* at MSY is equal to one half of *r* for this and all subsequent scenarios).

Scenario 2: *Large Coastal sharks, alternative catch.* A total of 17 CPUE series were used, each series being weighted by the inverse of its variance. Model fits to the indices are shown in Figure 4.3. The mean posterior for *r* was 0.051 (the mean prior for *r* was 0.113); the maximum sustainable catch in numbers (MSC) was 142,766 fish; stock size had continuously declined from 11,299,000 fish in 1974 to an estimated 2,081,000 fish in 1998; the stock size in 1998 was estimated to be about 18% of *K*; the catch in 1997 was about 2.3 times that which would produce MSC; and the 1997 fishing mortality rate (0.126) was about 6 times higher than that which would produce MSY.

Table 7. *Expected posterior values of parameters and time series for large coastals from the Bayesian production model analyses. Note K (carrying capacity), N's (abundance), MSC (maximum sustainable catch) and C 1975-80 (catch in 1975-80) are in thousands of sharks.*

	Large Coastals Baseline		Large Coastals Alternative Catch	
Parameter	Expected Value	CV	Expected Value	CV
K	9535	0.17	11754	0.16
r	0.07	0.51	0.05	0.50
C1975-80	284	0.39	327	0.42
MSC	149	0.38	143	0.40
N(98)	1385	0.25	2081	0.22
N(98)/K	0.15	0.24	0.18	0.23
N(98)/N(75)	0.16	0.22	0.18	0.19
C(97)/MSC	2.18	0.44	2.33	0.49

	Large Coastals Baseline						Large Coastals Alternative Catch				
	N	N/K	N/Nmsy	F/Fmsy	F		N	N/K	N/Nmsy	F/Fmsy	F
1974	8927	0.95	1.90	1.12	0.03	1974	11299	0.98	1.96	1.38	0.03
1975	8671	0.92	1.84	1.15	0.03	1975	10984	0.95	1.90	1.42	0.03
1976	8430	0.90	1.79	1.19	0.03	1976	10685	0.93	1.86	1.46	0.03
1977	8202	0.87	1.74	1.23	0.04	1977	10399	0.90	1.80	1.51	0.03
1978	7985	0.85	1.70	1.26	0.04	1978	10125	0.88	1.76	1.56	0.03
1979	7777	0.83	1.65	1.30	0.04	1979	9862	0.86	1.72	1.60	0.03
1980	7577	0.81	1.61	1.34	0.04	1980	9607	0.83	1.66	1.65	0.03
1981	7387	0.79	1.57	1.35	0.04	1981	9374	0.81	1.62	1.55	0.03
1982	7130	0.76	1.52	2.14	0.06	1982	9087	0.79	1.58	2.39	0.05
1983	6640	0.71	1.41	4.08	0.12	1983	8780	0.76	1.52	1.99	0.04
1984	6250	0.66	1.33	1.59	0.05	1984	8553	0.74	1.48	1.70	0.04
1985	6047	0.64	1.28	2.28	0.07	1985	8307	0.72	1.44	2.39	0.05
1986	5733	0.61	1.22	3.14	0.09	1986	7915	0.69	1.38	3.70	0.08
1987	5371	0.57	1.14	3.29	0.09	1987	7489	0.65	1.30	3.23	0.07
1988	4913	0.52	1.04	5.04	0.15	1988	6876	0.60	1.20	6.87	0.14
1989	4370	0.46	0.93	5.51	0.16	1989	6010	0.52	1.04	8.32	0.17
1990	3906	0.41	0.83	4.91	0.14	1990	5236	0.45	0.90	7.51	0.16
1991	3520	0.37	0.75	5.17	0.15	1991	4615	0.40	0.80	7.52	0.16
1992	3126	0.33	0.66	6.16	0.18	1992	4010	0.35	0.70	9.21	0.19
1993	2761	0.29	0.59	5.72	0.17	1993	3492	0.30	0.60	7.52	0.16
1994	2446	0.26	0.52	6.14	0.18	1994	3131	0.27	0.54	6.60	0.14
1995	2125	0.23	0.45	7.32	0.21	1995	2811	0.24	0.48	7.61	0.16
1996	1820	0.19	0.39	7.36	0.21	1996	2509	0.22	0.44	7.33	0.15
1997	1585	0.17	0.34	6.34	0.18	1997	2280	0.20	0.40	6.03	0.13

***Scenario 3:** Sandbar shark, baseline catch.* A total of 8 CPUE series were used, each series being weighted by the inverse of its variance. Model fits to the indices are shown in Figure 4.4. The mean posterior for r was 0.10 (the mean prior for r was 0.117); the maximum sustainable catch in numbers (MSC) was 71,264 fish; stock size had continuously declined from 3,311,200 fish in 1974 to an estimated 924,000 fish in 1998; the stock size in 1998 was estimated to be about 29% of K; the catch in 1997 was about 1.3 times that which would produce MSC; and the 1997 fishing mortality rate (0.093) was 2.7 times higher than that which would produce MSY.

***Scenario 4:** Sandbar shark, alternative catch.* A total of 8 CPUE series were used, each series being weighted by the inverse of its variance. Model fits to the indices are shown in Figure 4.5. The mean posterior for r (0.209) was much higher than in the previous scenario (the mean prior for r was 0.117); the maximum sustainable catch in numbers (MSC) increased to 109,043 fish; stock size was predicted to continuously decline from 2,960,000 fish in 1974 to an estimated 941,000 fish in 1998; the stock size in 1998 was estimated to be about 35% of K; the catch in 1997 was lower (0.85 times) than that which would produce MSC; and the 1997 fishing mortality rate (0.093) was about 1.6 times higher than that which would produce MSY. This scenario was the most optimistic of all considered.

Table 8. Expected posterior values of parameters and time series for sandbar from the Bayesian production model analyses. Note K (carrying capacity), N's (abundance), MSC (maximum sustainable catch) and C 1975-80 (catch in 1975-80) are in thousands of sharks.

	Sandbar Baseline		Sandbar Alternative Catch	
Parameter	Expected Value	CV	Expected Value	CV
K	3265	0.32	2870	0.42
r	0.10	0.70	0.21	0.79
C1975-80	170	0.54	126	0.56
MSC	71	0.55	109	0.41
N(98)	924	0.45	941	0.47
N(98)/K	0.29	0.39	0.35	0.37
N(98)/N(75)	0.29	0.41	0.35	0.41
C(97)/MSC	1.34	0.58	0.85	0.61

	Sandbar Baseline						Sandbar Alternative Catch				
	N	N/K	N/Nmsy	F/Fmsy	F		N	N/K	N/Nmsy	F/Fmsy	F
1974	3311	1.02	2.05	1.48	0.05	1974	2960	1.03	2.06	0.74	0.04
1975	3143	0.97	1.95	1.56	0.05	1975	2830	0.99	1.97	0.77	0.04
1976	2989	0.93	1.85	1.65	0.06	1976	2720	0.95	1.90	0.81	0.05
1977	2847	0.88	1.77	1.75	0.06	1977	2630	0.92	1.84	0.84	0.05
1978	2713	0.84	1.69	1.85	0.06	1978	2540	0.89	1.79	0.87	0.05
1979	2586	0.81	1.61	1.95	0.07	1979	2470	0.87	1.74	0.90	0.05
1980	2465	0.77	1.54	2.06	0.07	1980	2400	0.85	1.70	0.93	0.05
1981	2348	0.74	1.48	2.19	0.08	1981	2330	0.83	1.66	0.96	0.05
1982	2234	0.71	1.41	2.33	0.08	1982	2270	0.81	1.62	0.99	0.06
1983	2123	0.67	1.35	2.49	0.09	1983	2210	0.79	1.59	1.02	0.06
1984	2013	0.64	1.28	2.69	0.09	1984	2150	0.78	1.56	1.06	0.06
1985	1904	0.61	1.22	2.95	0.10	1985	2100	0.76	1.53	1.09	0.06
1986	1804	0.58	1.16	2.70	0.09	1986	2030	0.74	1.47	1.59	0.09
1987	1734	0.56	1.11	2.09	0.07	1987	1940	0.70	1.40	1.81	0.10
1988	1640	0.53	1.05	3.85	0.13	1988	1800	0.65	1.29	3.04	0.18
1989	1509	0.48	0.96	4.11	0.14	1989	1600	0.57	1.14	3.94	0.23
1990	1378	0.44	0.88	4.64	0.16	1990	1390	0.49	0.98	4.63	0.27
1991	1276	0.40	0.81	3.44	0.12	1991	1230	0.43	0.86	3.92	0.23
1992	1204	0.38	0.76	3.63	0.13	1992	1100	0.38	0.77	4.56	0.26
1993	1150	0.36	0.73	2.75	0.09	1993	1020	0.36	0.71	2.82	0.16
1994	1087	0.34	0.69	4.51	0.16	1994	977	0.34	0.68	3.31	0.19
1995	1018	0.32	0.64	3.57	0.12	1995	943	0.33	0.67	2.48	0.14
1996	971	0.31	0.61	3.50	0.12	1996	933	0.34	0.67	2.27	0.13
1997	941	0.30	0.59	2.70	0.09	1997	940	0.34	0.69	1.62	0.09

Scenario 5: Blacktip shark, baseline catch. A total of 7 CPUE series were used, each series being weighted by the inverse of its variance. Model fits to the indices are shown in Figure 4.6. The mean posterior for r was 0.117 (the mean prior for r was 0.136); the maximum sustainable catch in numbers (MSC) was 136,727 fish; stock size had continuously declined from 5,191,700 fish in 1974 to an estimated 1,383,000 fish in 1998; the stock size in 1998 was predicted to be about 25% of K; the catch in 1997 was about 1.8 times that which would produce MSC; and the 1997 fishing mortality rate (0.172) was about 3.5 times higher than that which would produce MSY.

Scenario 6: Blacktip shark, alternative catch. A total of 7 CPUE series were used, each series being weighted by the inverse of its variance. Model fits to the indices are shown in Figure 4.7. The mean posterior for *r* was 0.114 (the mean prior for *r* was 0.136); the maximum sustainable catch in numbers (MSC) was 156,884 fish; stock size had continuously declined from 6,103,000 fish in 1974 to an estimated 1,441,000 fish in 1998; the stock size in 1998 was estimated to be about 22% of *K*; the catch in 1997 was about 1.6 times that which would produce MSC; and the 1997 fishing mortality rate (0.166) was about 3.7 times higher than that which would produce MSY.

Table 9. *Expected posterior values of parameters and time series for blacktip from the Bayesian production model analyses. Note K (carrying capacity), N's (abundance), MSC (maximum sustainable catch) and C 1975-85 (catch in 1975-80) are in thousands of sharks.*

Parameter	Blacktip Baseline Expected Value	CV	Blacktip Alternative Catch Expected Value	CV
K	5527	0.31	6532	0.29
r	0.12	0.70	0.11	0.70
C1975-85	81	0.37	235	0.38
MSC	137	0.43	157	0.45
N(98)	1383	0.57	1441	0.56
N(98)/K	0.25	0.43	0.22	0.40
N(98)/N(75)	0.27	0.47	0.25	0.45
C(97)/MSC	1.84	0.49	1.63	0.50

	Blacktip Baseline N	N/K	N/Nmsy	F/Fmsy	F		Blacktip Alternative Catch N	N/K	N/Nmsy	F/Fmsy	F
1974	5192	0.96	1.91	0.93	0.05	1974	6103	0.95	1.90	0.94	0.04
1975	4996	0.92	1.84	0.97	0.05	1975	5899	0.91	1.83	0.98	0.04
1976	4820	0.89	1.77	1.01	0.05	1976	5715	0.88	1.77	1.02	0.05
1977	4659	0.86	1.71	1.05	0.05	1977	5548	0.86	1.71	1.05	0.05
1978	4510	0.83	1.66	1.09	0.05	1978	5393	0.83	1.67	1.09	0.05
1979	4371	0.80	1.60	1.12	0.05	1979	5249	0.81	1.62	1.12	0.05
1980	4240	0.78	1.56	1.16	0.06	1980	5113	0.79	1.58	1.16	0.05
1981	4116	0.76	1.51	1.20	0.06	1981	4985	0.77	1.54	1.19	0.05
1982	3997	0.74	1.47	1.24	0.06	1982	4862	0.75	1.50	1.23	0.05
1983	3884	0.71	1.43	1.28	0.06	1983	4745	0.73	1.47	1.26	0.06
1984	3774	0.70	1.39	1.32	0.06	1984	4633	0.72	1.43	1.30	0.06
1985	3667	0.68	1.35	1.37	0.07	1985	4524	0.70	1.40	1.34	0.06
1986	3545	0.66	1.31	1.61	0.08	1986	4393	0.68	1.36	1.59	0.07
1987	3399	0.63	1.26	1.81	0.09	1987	4211	0.65	1.30	2.01	0.09
1988	3191	0.59	1.18	2.70	0.13	1988	3903	0.60	1.21	3.43	0.15
1989	2936	0.54	1.08	2.92	0.14	1989	3493	0.54	1.08	4.02	0.18
1990	2747	0.50	1.01	2.15	0.11	1990	3184	0.49	0.98	2.83	0.13
1991	2577	0.47	0.95	2.97	0.14	1991	2916	0.45	0.89	4.04	0.18
1992	2342	0.43	0.86	3.78	0.18	1992	2541	0.39	0.77	5.64	0.25
1993	2115	0.39	0.77	3.51	0.17	1993	2203	0.33	0.67	4.68	0.21
1994	1916	0.35	0.70	3.91	0.19	1994	1975	0.30	0.60	4.28	0.19
1995	1738	0.32	0.63	3.70	0.18	1995	1804	0.27	0.54	4.02	0.18
1996	1597	0.29	0.58	3.61	0.18	1996	1667	0.25	0.50	3.89	0.17
1997	1481	0.27	0.54	3.52	0.17	1997	1555	0.23	0.47	3.74	0.17

The production model analyses for the large coastal shark aggregate (scenarios 1 and 2), the sandbar shark (scenarios 3 and 4), and the blacktip shark (scenarios 5 and 6) should be regarded as separate. For large coastal sharks combined, inclusion of underreporting in the catches (scenario 2) had little effect on the estimated parameters and the main conclusion is that the 1998 catch is twice as high as that which would produce MSY. The assessment for sandbar sharks alone (scenarios 3 and 4) is not so pessimistic. While the 1998 catch is estimated to be 34% higher than that which would produce MSY when considering baseline catches (scenario 3), the prediction is more optimistic when including underreporting in the model (scenario 4) and in fact indicates that the 1998 catch is about 15% smaller than that which would produce MSY. Predictions for the blacktip shark alone (scenarios 5 and 6) lie somewhere between those for the large coastal aggregate and the sandbar shark, but still indicate that blacktip sharks are being overfished, with relatively little effect when accounting for underreporting (scenario 6).

4.2. Model Projections

The joint posterior distribution for population model parameters obtained after fitting the stock production model to CPUE data and estimates of intrinsic rate of increase was used to represent uncertainty in the evaluation of alternative harvesting options as in SB-IV-26, 27. The alternative total allowable catch (TAC) policies examined included a no catch option and a 10%, 20%, 30%, 40%, and 50% (status quo) catch of the 1995 level, respectively. All policies assumed constant catch. Stock size was projected forward 10, 20, and 30 yr and the ratio of stock size to carrying capacity (*Nfin/K*), and the probability of stock size being less than 20% of *K* (*Nfin*<0.2*K*), more than 50% of *K* (*Nfin*>0.5*K*), more than the 1998 stock size (*Nfin*>*N98*), and more than the 1993 stock size (*N98*>*N93*) was evaluated for each policy at each time step. Detailed results of these and other additional projections are presented in Appendix 2; projections for Large Coastal and Sandbar shark abundance relative to *K* (with confidence intervals) are given in Figures 4.8 and 4.9. Projection results under each scenario are summarized next.

Scenario 1: Large Coastal sharks, baseline catch. Projections indicated that the status quo policy (50% reduction in 1995 catch) would not allow recovery of the stock (*Nfin/K*=0.01 after 10, 20, and 30 yr), with the probability that stock size after 10, 20, and 30 yr were larger than the 1998 stock size being negligible. The no catch policy (0 quota) indicated that the stock would reach the MSY level (*Nfin/K*=0.5) only after 30 yr under this policy, with an associated probability of stock size after 30 yr being larger than the MSY level (*Nfin*>0.5*K*) of 46%.

Scenario 2: Large Coastal sharks, alternative catch. Predictions under this scenario incorporating expanded catch did not differ much from the previous scenario. In addition to the no catch policy (0 quota), which indicated that the stock would almost reach the MSY level (*Nfin/K*=0.47) only after 30 yr, the 10% of 1995 catch option also showed a slowly recovering trajectory, with stock size as a proportion of *K* increasing from 0.22 after 10 yr, to 0.27 after 20 yr, and to 0.34 after 30 yr.

Scenario 3: Sandbar shark, baseline catch. Projections indicated that the status quo policy would stabilize the stock level, but would not allow recovery (*Nfin/K*=0.3 after 10 yr, and 0.31 after 20 and 30 yr), with a probability of 41% that the stock size after 10, 20, and 30 yr would be larger than the 1998 stock size. All the other options predicted faster stock recovery, but only the no catch policy allowed the stock to almost reach the MSY level after 10 yr. With the 10% and 20% of 1995 catch options MSY could be reached after 20 yr, and after 30 yr, MSY could be reached with the 10%, 20%, and 30% of 1995 catch options.

Scenario 4: Sandbar shark, alternative catch. Projections under this alternative catch scenario for the sandbar shark were by far the most optimistic. All catch policies allowed stock recovery to the level producing MSY after only 10 yr. The status quo policy had a 50% probability that stock size would be larger than the MSY level after 10 yr and a 74% probability that stock size would be larger than the 1998 stock size after 10 yr.

Scenario 5: Blacktip shark, baseline catch. Projections indicated that the status quo policy would not allow recovery of the blacktip shark stock (*Nfin/K*=0.17, 0.14, and 0.13 after 10, 20, and 30 yr, respectively), with the probability that stock size after 10, 20, and 30 yr were larger than the 1998 stock size being about 16%. The no catch policy indicated that the stock would reach the MSY level after between 10 and 20 yr. The only other policy that would allow for stock recovery after 20 yr was the 10% of 1995 catch option (*Nfin/K*=0.56). MSY was predicted to be reached with the no quota, and 10% and 20% of 1995 catch policies after 30 yr.

Scenario 6: Blacktip shark, alternative catch. Predictions under this scenario incorporating expanded catch followed the same general pattern as the baseline scenario for the blacktip shark. Thus, projections indicated that the status quo policy would not allow recovery of the blacktip shark stock (*Nfin/K*=0.16, 0.17, and 0.17 after 10, 20, and 30 yr, respectively), with the probability that stock size after 10, 20, and 30 yr were larger than the 1998 stock sizes being about 21%, 23%, and 23%, respectively. The no catch policy also indicated that the stock would reach the MSY level after between 10 and 20 yr. As in scenario 5, the only other policy that would allow for stock recovery after 20 yr was the 10% of 1995 catch option (*Nfin/K*=0.53) and MSY was predicted to be reached with the no quota, and 10% and 20% of 1995 catch policies after 30 yr.

4.3. Summary of Model, Projections and CPUE Results

There are a number of issues at which one should look critically in interpreting the various modeling results. These include: the fits of the population models to the catch rate data, the evidence of trends in the catch rates, the degree to which the population is "closed", and the effects of aggregation of species in the models and in the catch.

To understand the above factors, it is instructive to examine the fits of the production model to the CPUE data for large coastal and sandbar analyses (Figures 4.2-4.5). There is a tendency for residual patterns over the series (the model predicted values are less than many of the CPUE points in the early and late periods of the 1973-97 series). This is understandable in that the production model has but two parameters, so is relatively inflexible in trying to fit rapid changes in CPUE patterns. Therefore, recent changes in CPUE may not be well accommodated by the model. This might have caused some overestimation of the pre-1981 catch levels, as well. Additionally, the model assumes that changes are instantaneous. Thus, if catches change and CPUE's do not, then the model will reinterpret the value of *r* accordingly. These are model conditional concerns that are not encompassed in the precision estimates.

Also, the issue of closed versus open stocks and aggregation of species is still a problem. The production model assumes that the population being analyzed is closed (no net migration, no change in the mix of species being fished, no systematic changes in fleet composition) and is described by a parabolic production curve. In the past the production model results were high relative to the demographic analyses (and were extremely imprecise), but were interpreted by recognizing these caveats. In the analyses done this year, the demographic data were integrated into the production model through Bayesian priors on *r*. Because the priors on *r* were based on the demography, the Bayesian production model is less likely to fit open population effects. However, there is more correspondence between *r*'s from the demographic models with those from the production models in the single species blacktip and sandbar models than in the aggregated large coastal model. In any case, the values of the intrinsic rate of increase are critical to interpretation of future growth potential and overall potential productivity (MSY). Therefore, projection analyses were conducted from the Bayesian analyses conditional on *r* and are given in Appendix 2. Note that the Maximum Sustainable Catch (MSC in numbers) for large coastals is estimated to be less than the sum of the sandbar and blacktip estimates, which may be an indication of the species aggregation problem in estimating *r* and MSC.

There are two primary reasons why the aggregated large coastal analyses are more pessimistic than the separate-species analyses. The first is that the separate-species analyses did not incorporate time series with rates of decline as extreme as some of those used in the aggregate analyses (e.g., the shark tournament time series). Secondly, low productivity species such as dusky sharks may contribute to a steeper rate of decline for the aggregated species.

Recognizing the caveats mentioned in regard to the demographic modeling and production modeling, the results for the large coastal aggregation indicate that current (1998) stock size was estimated to be between 30 and 36% of MSY levels, and 1997 catch was estimated to be 218-233% of MSY (the ranges are defined by the mean values from two alternative catch scenarios). When analyses were disaggregated into sandbar and blacktip sharks, then for sandbar current stock size was estimated to be between 58 and 70% of MSY levels, and 1997 catch was estimated to be 85-134% of MSY. For blacktip, current stock size was estimated to be between 44 and 50% of MSY levels, and 1997 catch was estimated to be 163-184% of MSY. Thus, projections indicated that the large coastal aggregate complex might still require additional reductions in effective fishing mortality rate in order to ensure increases of this resource toward MSY. For the blacktip shark, projections also indicated a need for additional reductions, but it is unclear whether reductions in the U.S. alone would achieve the intended goals. Projections for sandbar were more optimistic suggesting that current catches are closer to replacement levels.

5. RESOURCE STATUS

5.1. Large Coastal Sharks

5.1.a. Maximum Sustainable Yield

The Fishery Management Plan (FMP) developed an argument for maximum sustainable yield (MSY) based upon analytical results from a 1992 Review Committee. That approach used maximum likelihood estimation procedures to compute various statistics of interest including stock sizes, fishing mortality rates and production. The FMP used the maximum of annual production estimates during the period of the data as a biological reference point by assuming that any annual production, including the maximum, is sustainable. Therefore, first approximations of maximum sustainable yield were taken as the maximum of the annual production estimates during the period of the data. In doing so it was recognized that a recovery plan was to be implemented through the FMP, which was designed to return the resources to a more biologically optimal level. It was also recognized that this first approximation of the resource level that might produce MSY was likely to be an underestimate (i.e., the true B_{MSY} was likely to be higher). Given the implementation of a recovery plan, the underestimate of this statistic was deemed acceptable in that in order for the resource to recover to MSY it would have to pass through the "first approximation" levels. In the ensuing time period some new information was brought to bear to improve the estimate of the MSY resource level. However, the resulting predicted equilibrium catch at maximum net productivity derived in the 1996 report (approximately 300,000 fish) was not felt to be of sufficient accuracy to alter the previous estimate of MSY.

Estimates of MSY (actually, MSC since results were expressed in numbers) derived in the six scenarios considered under the Bayesian approach placed MSC at about 143,000-149,000 fish for the Large Coastal Group (scenarios 1 and 2), at 71,000-109,000 sandbar sharks (scenarios 3 and 4), and at 137,000-157,000 blacktip sharks (scenarios 5 and 6). The sum of the sandbar and blacktip MSC results ranged from 208,000-266,000. This is in contrast with the MSC estimated for the Large Coastal Group in the 1993 FMP (346,691 fish) and with the MSC estimated in the production models used in the 1996 assessment.

As noted in the 1996 SEW report, an estimated MSY which could be substantially below the actual level is not in conflict with the general strategy in the FMP to recover the resource, in that the FMP recognized that any recovery strategy would have to achieve the "first approximation" target on the resource recovery trajectory (assuming that B_{MSY} is underestimated). Recovery to MSY is likely to be a lengthy process under the best of circumstances, and it is unlikely that full recovery of the resource to MSY stock level (B_{MSY}) could occur within a decade under any catch scenario.

5.1.b. Total Allowable Catch

The 1994 Workshop Report noted that in the case of sharks it was unreasonable to expect that sufficient additional data had accumulated since the implementation of the FMP to provide much more precise information to adjust the TAC at that time. Therefore, the approach taken in

1994 was to examine evidence that would suggest whether the exploitation rate and replacement yield originally chosen in the FMP as the target were risk-averse or risk-prone, given inexact information on current abundance, productivity rates, and harvest levels. In the 1994 and 1996 SEW Reports, it was noted that although CPUE observations show substantial declines from mid-1970's levels to the current levels, in the most recent years since 1991, the CPUE data are too few and variable and/or the trend is too flat to show statistically significant evidence that the stocks are either increasing or decreasing under the allowable catch level. Still the estimated trends (though variable) do not appear to be increasing (with the possible exception of sandbar). Thus, evidence is still equivocal regarding stock rebuilding or further depletion.

The commercial fishery has had a 50% reduction imposed in its catches. Since the expected rates of change in shark abundance are low, and our measures of stock abundance are uncertain, sufficient observational data are not yet available to detect changes in stock size since the most recent management measures were implemented with any certainty.

However, the balance of data indicate that there is a need for substantial reductions in catches of the large coastal species, exclusive of sandbar and blacktip. For sandbar, analyses indicate that small reductions are needed to ensure recovery. For blacktip, large reductions in catches may be needed, but it is unclear whether reductions in the U.S. alone would achieve the intended goals.

5.2. Small Coastal Sharks

Document SB-IV-12 indicates that small coastal commercial landings have increased from 209 mt dressed weight (dw) in 1996 to 326 mt dw in 1997 (1997 data are still preliminary). Atlantic sharpnose sharks made up 36 percent of the 1997 landings followed by blacknose (28%), finetooth (26%), and bonnethead (10%) sharks. Percentages were similar in 1996 with finetooth sharks making up a smaller proportion and additional landings of Caribbean sharpnose, Atlantic angel, and unclassified sharks. Preliminary recreational numbers for small coastal sharks indicate the Atlantic sharpnose shark comprises 67 percent of the harvest followed by bonnethead (16%) and blacknose (11%) sharks.

SB-IV-2 documents the results of an observer program for the commercial longline fishery off North Carolina, Atlantic coast of Florida, and Gulf of Mexico coast of Florida. Since 1994 through the first season of 1998, approximately 7,916 small coastal sharks (out of 26,351 total sharks) were caught. Atlantic sharpnose sharks comprised 84 percent (6,667 fish) of the small coastal catch followed by blacknose sharks (15%; 1,188 fish). Other small coastal species caught include bonnethead, finetooth, and Atlantic angel sharks.

In a fishery-independent survey described in document SB-IV-6, Atlantic sharpnose, finetooth, and bonnethead neonate and juvenile sharks were three of the most abundant species caught in both gillnets and longlines in two northwest Florida sampling stations. These results indicate the existence of a nursery area for these three species.

Document SB-IV-29 describes a longline survey conducted in 1995 and 1996 in the Gulf of Mexico and western North Atlantic. Three small coastal species (blacknose, finetooth, and Atlantic sharpnose) comprised 72% of all shark captures. Atlantic sharpnose sharks were caught in virtually all locations, whereas blacknose and finetooth sharks were only caught in the Gulf of Mexico.

No new analyses were conducted with which to modify estimated MSY or TAC of the small coastal sharks. Additional CPUE time series are needed before new analyses can be performed.

5.3. Pelagic Sharks

Document SB-IV-12 indicates that pelagic shark commercial landings have increased from 315 mt dw in 1996 to 433 mt dw in 1997 (1997 data are preliminary at this time). Unclassified, shortfin mako, and thresher sharks make up 98 percent of the landings. Oceanic whitetip sharks, which made up 30 percent of the landings in 1996 comprised only 0.40 percent of the landings in 1997. Preliminary recreational numbers indicate that blue sharks make up 51 percent of the harvest followed by shortfin mako (31%) and thresher (17%) sharks.

SB-IV-2 documents the results of an observer program for the commercial longline fishery off North Carolina, Atlantic coast of Florida, and Gulf of Mexico coast of Florida. Since 1994 through the first season of 1998, approximately 65 pelagic sharks (out of 26,351 total sharks) have been caught. Shortfin mako was the most abundant of the pelagic sharks caught (45 %; 29 fish) followed by common thresher (25%; 16 fish) and bigeye thresher (20%; 13 fish). Other pelagic species caught include sevengill, bigeye sixgill, and blue sharks.

Document SB-IV-5 indicates an increasing trend in the relative catch per 100 trips for blue sharks (1.04 in 1994 to a peak of 2.63 in 1996 and 1.68 in 1997) in the rod and reel fishery from Virginia through Massachusetts. The same document shows a fairly steady relative catch per 100 trips (ranging from 1.05 in 1994 to 1.55 in 1995) for mako sharks since the early 1990s (see figures to see variance of estimates).

Data from the pelagic longline logbook indicate the catch per 1,000 hooks set for pelagic sharks as a group has decreased since 1986 (12.3 in 1986 to 3.9 in 1997; Document SB-IV-11; see figure for variance). Individually, blue sharks, mako sharks, and thresher sharks also have decreasing catches per 1,000 hooks set (see figure for variance) although for both blue and thresher sharks the catch per 1,000 hooks set has increased slightly since 1995 (1.7 to 2.2 for blue sharks and 0.15 to 0.18 for thresher sharks). The catch per 1,000 hooks set for oceanic whitetip sharks has remained fairly constant (ranging from 0.06 in 1995 to 0.09 in 1997) since this species was added to the logbook in 1992 (see figure for variance).

Document SB-IV-22 describes the Atlantic pelagic shark bycatch in the tuna and swordfish pelagic longline fisheries. Estimates indicate that since 1993 the number of thresher sharks discarded dead appears to be increasing. In 1996, approximately 949 mt whole weight of pelagic sharks (blue, thresher, porbeagle, mako, oceanic whitetip, and unidentified pelagic species) were discarded dead. An estimated 75 percent of these sharks were blue sharks. In contrast, approximately 407 mt whole weight of pelagic sharks were landed. Mako sharks made up the majority of the landings (58%) followed by porbeagle (19%) and thresher sharks (15%). Less than 1 percent of the landings were blue sharks.

No new analyses were conducted with which to modify estimated MSY or TAC of the pelagic sharks. Additional CPUE time series are needed before new analyses can be performed.

6. MANAGEMENT IMPLICATIONS AND RECOMMENDATIONS

Total Allowable Catch. In 1997, NMFS reduced the commercial quota and recreational bag limits for Large Coastal Sharks (LCS) in order to achieve a 50 percent reduction in catch. Results indicate that the recreational catch of sharks now results in mortality higher than that of the commercial sector following the successfully implemented 50% reduction in the commercial catch last year (and earlier reductions) and the apparently unsuccessful implementation of reduced recreational bag limits, resulting in less than the intended 50% reduction from that sector.

The balance of data indicate that there is a need for substantial reductions in catches of the large coastal species, exclusive of sandbar and blacktip. For sandbar, analyses indicate that small reductions are needed to assure recovery. For blacktip, large reductions in catches may be needed, but it is unclear whether reductions in the U.S. alone would achieve the intended goals.

Every effort should be made to manage species separately. New analyses indicate that individual species are responding differently to exploitation (as was suspected in previous SEW Reports). Risk-neutral management of large coastal aggregates can result in excessive regulation on some species and excessive risk of overfishing on others. This Report makes the initial attempt to separate species for analysis. Options for carrying this forth through management should be explored (see minimum size discussion, for example).

If the LCS fishery must be managed in aggregate, then the ramifications for the directed commercial LCS fishery might be severe. Note that catches of LCS in incidental commercial fisheries (including the small coastal shark fishery when the LCS fishery is closed), which by definition catch sharks incidentally to other fishery operations, may continue to occur unless regulations limiting effort in those other fisheries are implemented. A reduced commercial quota may then result in increased discards of LCS in those incidental fisheries if they continue to operate unchanged, contrary to the desired reduction in effective fishing mortality.

The bag limits for Atlantic sharks in recreational fisheries were reduced by 50% in 1997 as a proxy to reducing effective fishing mortality equally across user groups. Evidence available to NMFS indicates that the bag limit reduction was not effective at reducing fishing mortality by the intended 50 percent (SB-IV-25 and Table 2). The recreational fisheries often target other species and encounter sharks incidentally. Reductions in recreational mortality might be achieved by not retaining those sharks caught incidentally. Post-release survival of sharks caught on rod and reel is expected to be relatively high such that restricting recreational fisheries to lower bag limits or to catch-and-release only fishing would still afford those fishers with the opportunity to fish while still resulting in a reduction in effective fishing mortality.

Minimum Sizes. It is possible that minimum size regulations could reduce fishing mortality on the younger, more sensitive life history stages/sizes while allowing fishing on the older, less sensitive stages/sizes. Two documents on the population dynamics of sandbar sharks (SB-IV-4 and SB-IV-9) outline essentially similar results in that younger life history stages or smaller sizes of sandbar sharks are more sensitive to mortality and that this sensitivity to mortality declines at the stage/size of first maturity or slightly earlier. These results, in combination with the directed shark observer data (SB-IV-1, 2, and 3), which demonstrate a clear segregation by size and depth of sandbar sharks (smaller fish predominate in the catches in nearshore waters and larger fish predominate in catches in deeper waters), suggest that a commercial minimum size for sandbar sharks could effectively push fishing effort into deeper waters. By pushing fishing effort into deeper waters where larger subadults and large adults predominate, effective fishing mortality could be reduced while still allowing fishing. Furthermore, Sminkey and Musick (SB-III-20) showed that by delaying entry into the fishery until approximately age 12-13 years, substantially higher levels of fishing effort could be maintained and positive population growth achieved. The size-depth segregation of sandbar sharks is likely to result in less bycatch of smaller, immature individuals, thereby reducing effective fishing mortality.

A commercial and recreational minimum size limit on ridgeback sharks would thus protect the more vulnerable large juvenile and subadult sandbar sharks and accord added protection to subadult dusky sharks and other species. It would also serve to reduce recreational mortality.

For blacktip sharks, the directed fishery observer data do not demonstrate clear size-depth segregation; these sharks occur in mixed-size schools in nearshore waters. As it may be difficult to target a stage/size class of blacktip sharks and thereby redistribute fishing mortality onto older, less sensitive stages/sizes, a commercial minimum size on blacktip sharks may actually increase effective fishing mortality as more small fish are caught and discarded dead in order to harvest the same quantity of larger fish.

In contrast, a recreational minimum size limit, perhaps in combination with a reduced bag limit, would be an effective way to reduce fishing mortality on the younger, and probably more sensitive, life history stages in this species. A minimum size limit corresponding to the minimum size at maturity in female blacktip sharks, was identified. It was noted that this minimum size limit should be applied to all non-ridgeback large coastal shark species to facilitate both regulation and enforcement.

For reasons similar to those mentioned under the discussion of total allowable catches, a minimum size for the recreational fisheries for Atlantic sharks in general may reduce effective fishing mortality while still allowing fishing. Due to the high post-release survival of many sharks caught on rod and reel, a minimum size in combination with bag limits could be effective in reducing mortality on the sensitive life history stages/sizes. Significant fisheries exist for sharks, including blacktip, sandbar, and dusky sharks, in nearshore waters generally held to be nursery areas. Concern is expressed that these recreational fisheries are targeting juvenile and subadult fish as evidenced by the average sizes of fish caught (SB-III-5). Implementing minimum sizes to protect these life history stages/sizes was generally supported as a means of significantly reducing effective fishing mortality.

Time/Area Closures. The Workshop discussions generally supported minimum size restrictions and total allowable catch restrictions over time/area closures as management measures for Federal waters. This was primarily due to the acknowledgement that most nursery areas, and therefore the areas the most appropriate for time/area closures, were managed under the authority of different States. Nevertheless, further analyses and discussion of management in State waters is needed.

Dusky Shark Status. There was general agreement that the status of dusky shark stocks is of special concern and warrants a precautionary, risk-averse approach in managing this species. In addition to the Virginia longline CPUE series showing marked declines since the mid-1970's, none of the additional catch rate indices covering the recent period demonstrated an increasing trend. Furthermore, vital rates for dusky sharks appear to be very low and thus this species is likely to be highly susceptible to overexploitation. These arguments led some Workshop participants to propose that dusky sharks be added to the list of prohibited species, noting that the NMFS Office of Protected Resources has added this species to its Candidate List.

Prohibited Species. In 1997, NMFS prohibited possession of five species of sharks: sand tiger (*Odontaspis taurus*), bigeye sand tiger (*Odontaspis noronhai*), whale (*Rhincodon typus*), basking (*Cetorhinus maximus*), and white (*Carcharodon carcharias*) sharks. These species were identified as highly susceptible to overexploitation and the prohibition on possession was a preventive measure to ensure that directed fisheries did not develop. These species had been included in the large coastal shark management unit until that rulemaking and had been determined to be overfished in the LCS aggregate stock assessment in 1996. When NMFS identified the list of overfished species in the 1997 Report to Congress, all species that comprised the LCS management unit were listed individually as overfished with the subsequent mandate to develop a rebuilding program within one year. Regarding the five prohibited species, only two species are encountered regularly in directed fisheries: sand tiger sharks in directed commercial longline operations and white sharks in directed recreational operations. The remaining three prohibited species (whale, basking, and bigeye sand tiger sharks) are encountered rarely in fishery operations. During this year's assessment, the night shark (*Carcharhinus signatus*) was also mentioned by some participants as a possible candidate for the prohibited species list, but it was generally felt that this was premature at this time.

7. RESEARCH RECOMMENDATIONS

The 1996 SEW report included several recommendations, many of which were acted upon in the interim. In particular, the recommendation to resolve the age uncertainties for sandbar has essentially been completed. The younger ages of maturity and longevity (about 15 and 30 years, respectively) are now generally accepted over the older ages (30 and 60 years, respectively). Research to determine the nursery areas for the most important commercial species continues both in the Gulf and Atlantic regions. The level of fishery-independent monitoring of sharks has increased, particularly with the continuation of the NMFS longline surveys in both the northeast and southeast areas. Attempts to characterize the Mexican and Canadian catches and to increase cooperation with the scientists of these countries have been initiated. In particular, some information on the species composition and volume of Mexican shark catches has been obtained and incorporated in this assessment as appropriate.

Some of the following recommendations reiterate those for which work has already begun, thus stressing the need to continue such research. Others are new recommendations arising out of discussions at the 1998 SEW. The order below does not indicate a priority order.

Continue research to determine nursery areas; expand such research to other areas and species. Although knowledge about both summer and winter nursery areas continues to grow, there is still a need for considerable additional research, including exploration of new areas and additional species. Studies of nursery areas should include both short-term tagging studies to estimate survival rates of young sharks in the nursery areas, and long-term tagging studies to determine the limits of the nurseries and the site specificity of the animals using them.

Expand tagging studies in the Gulf of Mexico. Tagging studies in both the eastern and western Gulf of Mexico are needed to determine whether blacktip and sandbar sharks migrate from the United States to Mexico or vice-versa, and to clarify the origin of sharks taken in various fisheries in both countries.

Continue data rescue projects. Studies should focus on locating and compiling existing set by set data, and data related to historical species composition. In particular, historical fin dealer databases that include data that could be related to the species and size composition of commercial catches prior to implementation of the FMP could be used in developing stage or size based population models.

Convert the Gulf of Mexico reeffish logbook indices from biomass to numbers to make them consistent with the other time series used. In the current assessment, it was assumed that average weights of blacktip have not changed substantially over the duration of the logbook time series and therefore the biomass index was included along with other indices based on numbers. This assumption needs to be checked.

Continue and expand fishery-independent monitoring of sharks. New fishery-independent time series (e.g., the NMFS longline surveys in the northeast and southeast regions and the NMFS gill net and longline surveys in the northeastern Gulf of Mexico) are just getting to the point where they are long enough to be used in quantitative stock assessments. These fishery-independent surveys should be continued and, if possible, expanded.

Increase observer sampling. Current fishery observer programs have yielded much needed information on the commercial shark fisheries. Even though the time series are short, they have been useful for a number of purposes (e.g., to calculate average weights for the various species in order to convert between numbers and biomass in other datasets), as well as providing indices of relative abundance. However, in order to increase the utility of observer data further, substantial increases are required in the number of observed directed shark fishery sets (particularly in the north-central and western Gulf of Mexico), as well as the number of observed pelagic longline sets.

Continue to characterize the Mexican and Canadian shark catches. Fisheries management requires an understanding of shark catches in adjacent fishing areas. Efforts to obtain and analyze available data on Mexican and Canadian shark catches should be continued and intensified.

Investigate possibilities for cooperative stock assessments and fisheries management systems. Avenues for joint stock assessments and potential future joint management (trans-Atlantic for pelagic sharks, and at least the United States and Mexico for large and small coastal sharks) should be explored to improve the accuracy of assessments and the effectiveness of management.

Standardize catch rate time series for factors thought to influence catch rates but not related to abundance. This requires detailed set by set information from commercial fishing and fishery-independent surveys. More detailed catch and effort records (e.g., daily catch and effort by fishing method, area and platform) from recreational angler surveys are also needed.

Continue development of size and stage based models for important individual shark species, including sandbar and blacktip sharks. Some stage-based models for sandbar sharks have proved useful in identifying life history stages particularly sensitive to mortality. Such modeling efforts should be continued and expanded to other species, particularly the blacktip shark. Additional research required to parameterize such models is also required, with a long-term view towards developing and using size or stage based models for stock assessments.

Increase research and assessment efforts on small coastal and pelagic sharks. Assessments of these groups have not been conducted since the FMP was implemented.

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9. GLOSSARY

This is a glossary of terms as used in this document.

Bayesian approach- A statistical procedure, based on Bayes theorem, in which unknown parameters are replaced by known distributions for those parameters observed previously, generally called priors.

Carrying capacity (K)- In density-dependent population theory, the value of population density at which the intrinsic rate of increase is 0.

Catch Per Unit of Effort (CPUE)- The number or weight of fish caught by a given amount of effort. CPUE is often used as a measure of relative abundance of a particular fish stock.

CV (coefficient of variation)- A measure of statistical variability equal to the standard deviation expressed as a percentage of the mean.

Fishing mortality rate (F)- The portion of total mortality in a fish stock attributable to fishing. Fishing mortality can be expressed as an instantaneous rate (the proportion of fish dying at any given time) or as an annual rate (the proportion of fish dying in one year).

Fork length (FL)- The length of a shark measured in a straight line from the tip of the snout to the posterior notch of the caudal fin.

GLM (General Linear Modeling)- A statistical procedure that provides a useful framework for examining multiple factors (including both discrete and continuous variables) and determining which ones are better predictors of the dependent variable.

Intrinsic rate of increase (r)- In population theory, the maximum instantaneous rate of population growth (also known as the intrinsic capacity for increase, per capita rate of population increase, or Malthusian parameter).

Large Coastal Sharks (LCS)- A management unit identified in the NMFS Fishery Management Plan for Sharks of the Atlantic Ocean that currently includes seventeen species of sharks. Blacktip and sandbar sharks are the two most important species in this group.

Marine Recreational Fishery Statistics Survey (MRFSS)- A survey conducted by the National Marine Fisheries Survey (NMFS) to estimate catch and effort in the recreational sector.

Maximum Sustainable Yield (MSY)- The maximum average catch or yield that can be taken on a continuous basis (sustainably) from a stock under prevailing ecological and environmental conditions. Also referred to as the Maximum Sustainable Catch (MSC).

mt (metric ton)- Equals 1,000 kg or about 2,205 pounds.

Natural mortality rate (M)- The portion of total mortality in a fish stock attributable to natural causes. Natural mortality can be expressed as an instantaneous rate (the proportion of fish dying at any given time) or as an annual rate (the proportion of fish dying in one year).

Pelagic sharks- A management unit identified in the NMFS Fishery Management Plan for Sharks of the Atlantic Ocean that currently includes ten species of sharks. The blue, shortfin mako, and thresher sharks are the most important species in this group.

q (catchability coefficient)- The part of a stock caught by a defined unit of effort. It can also be thought of as the efficiency of the vessels.

Ridgeback sharks- Those sharks that have an interdorsal ridge (a ridge between the first and second dorsal fins).

Small coastal sharks- A management unit identified in the NMFS Fishery Management Plan for Sharks of the Atlantic Ocean that currently includes seven species of sharks. The Atlantic sharpnose shark is the most important species in this group.

Stochastic simulation- A simulation involving a randomly determined sequence of observations obtained from a probability distribution. It implies randomness, as opposed to fixed or deterministic simulations.

Total Allowable Catch (TAC)- The annual allowed catch in biomass for a particular species or species group. It is a management decision.

Total length (TL)- The length of a shark measured in a straight line from the tip of the snout to the tip of the caudal fin.

Total mortality rate (Z)- The sum of the effects of natural mortality rate (M) and fishing mortality rate (F). Total mortality rate can be expressed as an instantaneous rate (the proportion of fish dying at any given time) or as an annual rate (the proportion of fish dying in one year).

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APPENDICES

Appendix 1. CPUE Series

Appendix Table 1. The CPUE series for sharks considered in the 1998 Shark Evaluation Report. Series are indicated by species or species group with source of information indicated. The index is the estimated mean CPUE and the CV is the estimated precision of the mean value. Type refers to whether the index is based on biomass or numbers. Observations with a CV of 1.0 are either nominal data for which no measure of the precision of the estimate was available (whole series) or estimates with very small sample sizes for which an estimate of CV could not be computed (individual years within series).

SPECIES	SERIES	TYPE	YEAR	INDEX	CV	SOURCE
large coastal	Gulf Reef logs	Biomass	90	280.41	0.39096	c,1
large coastal	Gulf Reef logs	Biomass	91	335.78	0.24266	c
large coastal	Gulf Reef logs	Biomass	92	281.70	0.27111	c
large coastal	Gulf Reef logs	Biomass	93	155.17	0.26968	c
large coastal	Gulf Reef logs	Biomass	94	145.34	0.27074	c
large coastal	Gulf Reef logs	Biomass	95	181.58	0.36975	c
large coastal	Brannon	Numbers	86	162.00	1.00000	c,2
large coastal	Brannon	Numbers	87	332.29	1.00000	c
large coastal	Brannon	Numbers	88	282.56	1.00000	c
large coastal	Brannon	Numbers	89	205.41	1.00000	c
large coastal	Brannon	Numbers	90	245.07	1.00000	c
large coastal	Brannon	Numbers	91	251.44	1.00000	c
large coastal	Brannon	Biomass	86	3244.00	1.00000	c,2
large coastal	Brannon	Biomass	87	9450.52	1.00000	c
large coastal	Brannon	Biomass	88	7882.87	1.00000	c
large coastal	Brannon	Biomass	89	5746.35	1.00000	c
large coastal	Brannon	Biomass	90	6547.36	1.00000	c
large coastal	Brannon	Biomass	91	6448.84	1.00000	c
large coastal	Hudson	Numbers	85	0.22	1.00000	r,2
large coastal	Hudson	Numbers	86	0.10	1.00000	r
large coastal	Hudson	Numbers	87	0.12	1.00000	r
large coastal	Hudson	Numbers	88	0.10	1.00000	r
large coastal	Hudson	Numbers	89	0.05	1.00000	r
large coastal	Hudson	Numbers	90	0.02	1.00000	r
large coastal	Hudson	Numbers	91	0.02	1.00000	r
large coastal	Crooke LL	Numbers	75	0.11	1.00000	c,3
large coastal	Crooke LL	Numbers	76	0.08	1.00000	c
large coastal	Crooke LL	Numbers	77	0.13	1.00000	c
large coastal	Crooke LL	Numbers	78	0.25	1.00000	c
large coastal	Crooke LL	Numbers	79	0.12	1.00000	c
large coastal	Crooke LL	Numbers	80	0.16	1.00000	c
large coastal	Crooke LL	Numbers	81	0.13	1.00000	c
large coastal	Crooke LL	Numbers	82	0.13	1.00000	c
large coastal	Crooke LL	Numbers	83	0.14	1.00000	c
large coastal	Crooke LL	Numbers	84	0.12	1.00000	c
large coastal	Crooke LL	Numbers	85	0.14	1.00000	c
large coastal	Crooke LL	Numbers	86	0.11	1.00000	c
large coastal	Crooke LL	Numbers	87	0.08	1.00000	c
large coastal	Crooke LL	Numbers	88	0.08	1.00000	c
large coastal	Crooke LL	Numbers	89	0.09	1.00000	c
large coastal	SHARK Observer	Numbers	94	2.173	1.00000	c,4
large coastal	SHARK Observer	Numbers	95	3.066	1.00000	c
large coastal	SHARK Observer	Numbers	96	3.227	1.00000	c
large coastal	SHARK Observer	Numbers	97	3.480	1.00000	c
large coastal	Jax	Numbers	79	0.59	1.00000	r,3
large coastal	Jax	Numbers	84	0.71	1.00000	r
large coastal	Jax	Numbers	90	0.16	1.00000	r
large coastal	NC #	Numbers	88	999.10	0.42199	c,3
large coastal	NC #	Numbers	89	1637.36	0.23219	c

large coastal	NC KG	Biomass	88	837.85	0.50421	c,3
large coastal	NC KG	Biomass	89	2398.68	0.28493	c
large coastal	SC LL	Numbers	83	6.22	1.00000	i,5
large coastal	SC LL	Numbers	94	2.44	1.00000	i
large coastal	SC LL	Numbers	95	1.75	1.00000	i
large coastal	Port Salerno	Numbers	76	0.18	1.00000	r,3
large coastal	Port Salerno	Numbers	77	0.81	1.00000	r
large coastal	Port Salerno	Numbers	79	0.89	1.00000	r
large coastal	Port Salerno	Numbers	80	0.82	1.00000	r
large coastal	Port Salerno	Numbers	81	0.39	1.00000	r
large coastal	Port Salerno	Numbers	82	0.50	1.00000	r
large coastal	Port Salerno	Numbers	83	0.12	1.00000	r
large coastal	Port Salerno	Numbers	84	0.10	1.00000	r
large coastal	Port Salerno	Numbers	85	0.15	1.00000	r
large coastal	Port Salerno	Numbers	86	0.50	1.00000	r
large coastal	Port Salerno	Numbers	87	0.32	1.00000	r
large coastal	Port Salerno	Numbers	88	0.20	1.00000	r
large coastal	Port Salerno	Numbers	89	0.12	1.00000	r
large coastal	Port Salerno	Numbers	90	0.20	1.00000	r
large coastal	Tampa Bay	Numbers	85	0.16	1.00000	r,3
large coastal	Tampa Bay	Numbers	86	0.09	1.00000	r
large coastal	Tampa Bay	Numbers	87	0.03	1.00000	r
large coastal	Tampa Bay	Numbers	88	0.14	1.00000	r
large coastal	Tampa Bay	Numbers	89	0.06	1.00000	r
large coastal	Tampa Bay	Numbers	90	0.05	1.00000	r
large coastal	Virginia LL	Numbers	74	1.83	0.2893	i,6
large coastal	Virginia LL	Numbers	75	3.49	0.2980	i
large coastal	Virginia LL	Numbers	76	5.85	0.3509	i
large coastal	Virginia LL	Numbers	77	1.18	0.3818	i
large coastal	Virginia LL	Numbers	78	5.36	1.0000	i
large coastal	Virginia LL	Numbers	79	5.42	1.0000	i
large coastal	Virginia LL	Numbers	80	3.11	0.1799	i
large coastal	Virginia LL	Numbers	81	2.78	0.1640	i
large coastal	Virginia LL	Numbers	82	1.30	1.0000	i
large coastal	Virginia LL	Numbers	83	1.21	0.1513	i
large coastal	Virginia LL	Numbers	84	1.44	0.2715	i
large coastal	Virginia LL	Numbers	85	0.71	1.0000	i
large coastal	Virginia LL	Numbers	86	0.72	0.3790	i
large coastal	Virginia LL	Numbers	87	1.21	0.5224	i
large coastal	Virginia LL	Numbers	88	1.29	0.2374	i
large coastal	Virginia LL	Numbers	89	1.09	0.3991	i
large coastal	Virginia LL	Numbers	90	0.42	0.2341	i
large coastal	Virginia LL	Numbers	91	0.50	0.2498	i
large coastal	Virginia LL	Numbers	92	0.32	0.3281	i
large coastal	Virginia LL	Numbers	93	0.52	0.4552	i
large coastal	Virginia LL	Numbers	95	0.83	0.2672	i
large coastal	Virginia LL	Numbers	96	1.07	0.2238	i
large coastal	Virginia LL	Numbers	97	0.71	0.2270	i
large coastal	LPS	Numbers	86	52.91	0.142	r,11
large coastal	LPS	Numbers	87	40.42	0.175	r
large coastal	LPS	Numbers	88	32.50	0.210	r
large coastal	LPS	Numbers	89	65.42	0.128	r
large coastal	LPS	Numbers	90	24.40	0.241	r
large coastal	LPS	Numbers	91	46.45	0.148	r
large coastal	LPS	Numbers	92	20.64	0.289	r
large coastal	LPS	Numbers	93	13.53	0.465	r
large coastal	LPS	Numbers	94	4.51	1.136	r
large coastal	LPS	Numbers	95	18.22	0.366	r
large coastal	LPS	Numbers	96	25.91	0.356	r
large coastal	LPS	Numbers	97	16.65	0.469	r
large coastal	charter boat	Numbers	89	411.44	0.12503	r,7
large coastal	charter boat	Numbers	90	370.33	0.12126	r
large coastal	charter boat	Numbers	91	387.92	0.11813	r
large coastal	charter boat	Numbers	92	300.56	0.12485	r
large coastal	charter boat	Numbers	93	339.37	0.15622	r
large coastal	charter boat	Numbers	94	333.26	0.15174	r

large coastal	charter boat	Numbers	95	372.11	0.12218	r
large coastal	pelagic logbook	Numbers	86	13.254	0.22325	c,8
large coastal	pelagic logbook	Numbers	87	8.506	0.11672	c
large coastal	pelagic logbook	Numbers	88	10.646	0.10626	c
large coastal	pelagic logbook	Numbers	89	8.570	0.10109	c
large coastal	pelagic logbook	Numbers	90	10.677	0.09093	c
large coastal	pelagic logbook	Numbers	91	8.030	0.10314	c
large coastal	pelagic logbook	Numbers	92	7.964	0.06034	c
large coastal	pelagic logbook	Numbers	93	7.144	0.06303	c
large coastal	pelagic logbook	Numbers	94	4.464	0.06670	c
large coastal	pelagic logbook	Numbers	95	3.696	0.07387	c
large coastal	pelagic logbook	Numbers	96	3.383	0.08596	c
large coastal	pelagic logbook	Numbers	97	3.000	0.08858	c
large coastal	MRFSS,HBOAT,TX1	Numbers	81	4.60	1.00000	r,9
large coastal	MRFSS,HBOAT,TX1	Numbers	82	5.88	1.00000	r
large coastal	MRFSS,HBOAT,TX1	Numbers	83	10.52	1.00000	r
large coastal	MRFSS,HBOAT,TX1	Numbers	84	4.79	1.00000	r
large coastal	MRFSS,HBOAT,TX1	Numbers	85	5.18	1.00000	r
large coastal	MRFSS,HBOAT,TX1	Numbers	86	4.78	1.00000	r
large coastal	MRFSS,HBOAT,TX1	Numbers	87	4.24	1.00000	r
large coastal	MRFSS,HBOAT,TX1	Numbers	88	4.16	1.00000	r
large coastal	MRFSS,HBOAT,TX1	Numbers	89	3.32	1.00000	r
large coastal	MRFSS,HBOAT,TX1	Numbers	90	3.09	1.00000	r
large coastal	MRFSS,HBOAT,TX1	Numbers	91	3.62	1.00000	r
large coastal	MRFSS,HBOAT,TX1	Numbers	92	4.23	1.00000	r
large coastal	MRFSS,HBOAT,TX2	Numbers	93	3.22	1.00000	r,9
large coastal	MRFSS,HBOAT,TX2	Numbers	94	2.07	1.00000	r
large coastal	MRFSS,HBOAT,TX2	Numbers	95	2.30	1.00000	r
large coastal	MRFSS,HBOAT,TX2	Numbers	96	2.214	1.00000	r
large coastal	MRFSS,HBOAT,TX2	Numbers	97	1.799	1.00000	r
(large coastal	NMFS LL NE	Numbers	86	3.796	0.8372	i),12
large coastal	NMFS LL NE	Numbers	89	4.061	0.4869	i
large coastal	NMFS LL NE	Numbers	91	2.192	0.7075	i
large coastal	NMFS LL NE	Numbers	96	0.639	0.4929	i
large coastal	NMFS LL NE	Numbers	98	3.374	0.5496	i
large coastal	NMFS LL SE	Numbers	95	1.441	0.11	i,13
large coastal	NMFS LL SE	Numbers	96	0.511	0.14	i
large coastal	NMFS LL SE	Numbers	97	0.896	0.12	i
sandbar	Gulf Reef logs	Biomass	93	82.721	0.157	i,10
sandbar	Gulf Reef logs	Biomass	94	119.876	0.282	i
sandbar	Gulf Reef logs	Biomass	95	168.608	0.115	i
sandbar	Gulf Reef logs	Biomass	96	143.415	0.062	i
sandbar	Gulf Reef logs	Biomass	97	120.179	0.083	i
sandbar	Virginia LL	Numbers	74	0.981	0.3139	i,6
sandbar	Virginia LL	Numbers	75	1.318	0.3133	i
sandbar	Virginia LL	Numbers	76	3.158	0.3804	i
sandbar	Virginia LL	Numbers	77	0.918	0.5369	i
sandbar	Virginia LL	Numbers	78	1.190	1.0000	i
sandbar	Virginia LL	Numbers	79	1.667	1.0000	i
sandbar	Virginia LL	Numbers	80	1.681	0.1755	i
sandbar	Virginia LL	Numbers	81	2.071	0.1645	i
sandbar	Virginia LL	Numbers	82	0.521	1.0000	i
sandbar	Virginia LL	Numbers	83	0.707	0.2738	i
sandbar	Virginia LL	Numbers	84	0.537	0.6038	i
sandbar	Virginia LL	Numbers	85	0.714	1.0000	i
sandbar	Virginia LL	Numbers	86	0.493	1.0000	i
sandbar	Virginia LL	Numbers	87	0.521	0.5462	i
sandbar	Virginia LL	Numbers	88	0.848	0.5007	i
sandbar	Virginia LL	Numbers	89	0.952	0.4327	i
sandbar	Virginia LL	Numbers	90	0.202	0.3792	i
sandbar	Virginia LL	Numbers	91	0.292	0.3474	i
sandbar	Virginia LL	Numbers	92	0.070	0.4322	i
sandbar	Virginia LL	Numbers	93	0.381	0.5841	i
sandbar	Virginia LL	Numbers	95	0.616	0.2950	i
sandbar	Virginia LL	Numbers	96	0.716	0.2975	i

sandbar	Virginia LL	Numbers	97	0.571	0.2817	i
sandbar	pelagic logbook	Numbers	94	0.932	0.2405	c,8
sandbar	pelagic logbook	Numbers	95	2.573	0.1671	c
sandbar	pelagic logbook	Numbers	96	2.766	0.1705	c
sandbar	pelagic logbook	Numbers	97	2.291	0.1720	c
sandbar	MRFSS,HBOAT,TX1	Numbers	81	2.24	1.00000	r,9
sandbar	MRFSS,HBOAT,TX1	Numbers	82	0.47	1.00000	r
sandbar	MRFSS,HBOAT,TX1	Numbers	83	5.86	1.00000	r
sandbar	MRFSS,HBOAT,TX1	Numbers	84	1.06	1.00000	r
sandbar	MRFSS,HBOAT,TX1	Numbers	85	0.95	1.00000	r
sandbar	MRFSS,HBOAT,TX1	Numbers	86	1.39	1.00000	r
sandbar	MRFSS,HBOAT,TX1	Numbers	87	0.44	1.00000	r
sandbar	MRFSS,HBOAT,TX1	Numbers	88	0.90	1.00000	r
sandbar	MRFSS,HBOAT,TX1	Numbers	89	0.41	1.00000	r
sandbar	MRFSS,HBOAT,TX1	Numbers	90	0.85	1.00000	r
sandbar	MRFSS,HBOAT,TX1	Numbers	91	0.45	1.00000	r
sandbar	MRFSS,HBOAT,TX1	Numbers	92	0.50	1.00000	r
sandbar	MRFSS,HBOAT,TX2	Numbers	93	0.34	1.00000	r,9
sandbar	MRFSS,HBOAT,TX2	Numbers	94	0.19	1.00000	r
sandbar	MRFSS,HBOAT,TX2	Numbers	95	0.32	1.00000	r
sandbar	MRFSS,HBOAT,TX2	Numbers	96	0.417	1.00000	r
sandbar	MRFSS,HBOAT,TX2	Numbers	97	0.459	1.00000	r
(sandbar	NMFS LL NE	Numbers	86	2.700	0.6730	i),12
sandbar	NMFS LL NE	Numbers	89	2.514	0.3949	i
sandbar	NMFS LL NE	Numbers	91	0.982	0.4583	i
sandbar	NMFS LL NE	Numbers	96	0.412	0.3436	i
sandbar	NMFS LL NE	Numbers	98	2.455	0.4248	i
sandbar	NMFS LL SE	Numbers	95	0.236	0.257	i,13
sandbar	NMFS LL SE	Numbers	96	0.128	0.271	i
sandbar	NMFS LL SE	Numbers	97	0.232	0.310	i
sandbar	SC LL	Numbers	83	4.73	1.00000	i,5
sandbar	SC LL	Numbers	94	0.41	1.00000	i
sandbar	SC LL	Numbers	95	0.39	1.00000	i
sandbar	SHARK Observer	Numbers	94	0.424	1.00000	c,4
sandbar	SHARK Observer	Numbers	95	1.464	1.00000	c
sandbar	SHARK Observer	Numbers	96	1.861	1.00000	c
sandbar	SHARK Observer	Numbers	97	2.061	1.00000	c
blacktip	Gulf Reef logs	Biomass	93	45.697	0.266	i,10
blacktip	Gulf Reef logs	Biomass	94	10.215	0.406	i
blacktip	Gulf Reef logs	Biomass	95	93.882	0.265	i
blacktip	Gulf Reef logs	Biomass	96	133.368	0.083	i
blacktip	Gulf Reef logs	Biomass	97	125.625	0.089	i
blacktip	pelagic logbook	Numbers	92	1.637	0.2508	c,8
blacktip	pelagic logbook	Numbers	93	2.008	0.1309	c
blacktip	pelagic logbook	Numbers	94	1.456	0.1396	c
blacktip	pelagic logbook	Numbers	95	1.108	0.1654	c
blacktip	pelagic logbook	Numbers	96	1.118	0.1783	c
blacktip	pelagic logbook	Numbers	97	0.910	0.2013	c
blacktip	MRFSS,HBOAT,TX1	Numbers	81	9.52	1.00000	r,9
blacktip	MRFSS,HBOAT,TX1	Numbers	82	10.04	1.00000	r
blacktip	MRFSS,HBOAT,TX1	Numbers	83	4.74	1.00000	r
blacktip	MRFSS,HBOAT,TX1	Numbers	84	7.12	1.00000	r
blacktip	MRFSS,HBOAT,TX1	Numbers	85	13.77	1.00000	r
blacktip	MRFSS,HBOAT,TX1	Numbers	86	18.23	1.00000	r
blacktip	MRFSS,HBOAT,TX1	Numbers	87	17.46	1.00000	r
blacktip	MRFSS,HBOAT,TX1	Numbers	88	19.35	1.00000	r
blacktip	MRFSS,HBOAT,TX1	Numbers	89	16.73	1.00000	r
blacktip	MRFSS,HBOAT,TX1	Numbers	90	13.63	1.00000	r
blacktip	MRFSS,HBOAT,TX1	Numbers	91	18.60	1.00000	r
blacktip	MRFSS,HBOAT,TX1	Numbers	92	21.87	1.00000	r
blacktip	MRFSS,HBOAT,TX2	Numbers	93	14.09	1.00000	r,9

blacktip	MRFSS,HBOAT,TX2	Numbers	94	8.48	1.00000	r
blacktip	MRFSS,HBOAT,TX2	Numbers	95	8.40	1.00000	r
blacktip	MRFSS,HBOAT,TX2	Numbers	96	9.21	1.00000	r
blacktip	MRFSS,HBOAT,TX2	Numbers	97	7.62	1.00000	r
blacktip	SHARK Observer	Numbers	94	0.143	1.00000	c,4
blacktip	SHARK Observer	Numbers	95	0.592	1.00000	c
blacktip	SHARK Observer	Numbers	96	0.333	1.00000	c
blacktip	SHARK Observer	Numbers	97	0.143	1.00000	c
(blacktip	NMFS LL NE	Numbers	86	0.00	0.00	i),12
blacktip	NMFS LL NE	Numbers	89	0.06	0.2474	i
blacktip	NMFS LL NE	Numbers	91	0.13	0.1613	i
blacktip	NMFS LL NE	Numbers	96	0.03	0.2072	i
blacktip	NMFS LL NE	Numbers	98	0.13	0.3856	i
blacktip	NMFS LL SE	Numbers	95	0.205	0.325	i,13
blacktip	NMFS LL SE	Numbers	96	0.121	0.328	i
blacktip	NMFS LL SE	Numbers	97	0.224	0.267	i
dusky	Virginia LL	Numbers	74	0.154	1.0000	i,6
dusky	Virginia LL	Numbers	75	0.911	0.3907	i
dusky	Virginia LL	Numbers	76	1.414	1.0000	i
dusky	Virginia LL	Numbers	77	0.164	0.7155	i
dusky	Virginia LL	Numbers	78	3.571	1.0000	i
dusky	Virginia LL	Numbers	79	0.000	1.0000	i
dusky	Virginia LL	Numbers	80	0.933	0.4219	i
dusky	Virginia LL	Numbers	81	0.379	0.4000	i
dusky	Virginia LL	Numbers	82	0.000	1.0000	i
dusky	Virginia LL	Numbers	83	0.069	1.0000	i
dusky	Virginia LL	Numbers	84	0.633	1.0000	i
dusky	Virginia LL	Numbers	85	0.000	1.0000	i
dusky	Virginia LL	Numbers	86	0.000	1.0000	i
dusky	Virginia LL	Numbers	87	0.097	0.6227	i
dusky	Virginia LL	Numbers	88	0.000	1.0000	i
dusky	Virginia LL	Numbers	89	0.068	1.0000	i
dusky	Virginia LL	Numbers	90	0.030	0.6959	i
dusky	Virginia LL	Numbers	91	0.040	0.7467	i
dusky	Virginia LL	Numbers	92	0.011	1.0000	i
dusky	Virginia LL	Numbers	93	0.096	0.6272	i
dusky	Virginia LL	Numbers	95	0.048	0.8168	i
dusky	Virginia LL	Numbers	96	0.224	0.4124	i
dusky	Virginia LL	Numbers	97	0.000	1.0000	i
dusky	MRFSS,HBOAT,TX1	Numbers	81	6.30	1.00000	r,9
dusky	MRFSS,HBOAT,TX1	Numbers	82	1.28	1.00000	r
dusky	MRFSS,HBOAT,TX1	Numbers	83	3.01	1.00000	r
dusky	MRFSS,HBOAT,TX1	Numbers	84	5.74	1.00000	r
dusky	MRFSS,HBOAT,TX1	Numbers	85	2.15	1.00000	r
dusky	MRFSS,HBOAT,TX1	Numbers	86	2.34	1.00000	r
dusky	MRFSS,HBOAT,TX1	Numbers	87	3.53	1.00000	r
dusky	MRFSS,HBOAT,TX1	Numbers	88	2.09	1.00000	r
dusky	MRFSS,HBOAT,TX1	Numbers	89	1.82	1.00000	r
dusky	MRFSS,HBOAT,TX1	Numbers	90	1.50	1.00000	r
dusky	MRFSS,HBOAT,TX1	Numbers	91	1.66	1.00000	r
dusky	MRFSS,HBOAT,TX1	Numbers	92	3.92	1.00000	r
dusky	MRFSS,HBOAT,TX2	Numbers	93	0.48	1.00000	r,9
dusky	MRFSS,HBOAT,TX2	Numbers	94	1.21	1.00000	r
dusky	MRFSS,HBOAT,TX2	Numbers	95	1.04	1.00000	r
dusky	SHARK Observer	Numbers	94	0.060	1.00000	c,4
dusky	SHARK Observer	Numbers	95	0.244	1.00000	c
dusky	SHARK Observer	Numbers	96	0.210	1.00000	c
dusky	SHARK Observer	Numbers	97	0.188	1.00000	c
dusky	pelagic logbook	Numbers	92	1.097	0.1973	c,8
dusky	pelagic logbook	Numbers	93	1.196	0.1168	c
dusky	pelagic logbook	Numbers	94	0.734	0.1205	c
dusky	pelagic logbook	Numbers	95	0.708	0.1311	c
dusky	pelagic logbook	Numbers	96	0.618	0.1596	c
dusky	pelagic logbook	Numbers	97	0.538	0.1772	c

(dusky	NMFS LL NE	Numbers	86	0.296	0.2207	i),12
dusky	NMFS LL NE	Numbers	89	0.095	0.1209	i
dusky	NMFS LL NE	Numbers	91	0.054	0.1355	i
dusky	NMFS LL NE	Numbers	96	0.029	0.2122	i
dusky	NMFS LL NE	Numbers	98	0.143	0.2301	i
tiger	Virginia LL	Numbers	74	0.380	0.7095	i,6
tiger	Virginia LL	Numbers	75	0.054	0.6620	i
tiger	Virginia LL	Numbers	76	0.241	0.7654	i
tiger	Virginia LL	Numbers	77	0.102	1.0000	i
tiger	Virginia LL	Numbers	78	0.000	1.0000	i
tiger	Virginia LL	Numbers	79	0.000	1.0000	i
tiger	Virginia LL	Numbers	80	0.048	1.0000	i
tiger	Virginia LL	Numbers	81	0.078	0.4870	i
tiger	Virginia LL	Numbers	82	0.000	1.0000	i
tiger	Virginia LL	Numbers	83	0.196	0.6425	i
tiger	Virginia LL	Numbers	84	0.105	1.0000	i
tiger	Virginia LL	Numbers	85	0.000	1.0000	i
tiger	Virginia LL	Numbers	86	0.000	1.0000	i
tiger	Virginia LL	Numbers	87	0.028	1.0000	i
tiger	Virginia LL	Numbers	88	0.070	1.0000	i
tiger	Virginia LL	Numbers	89	0.000	1.0000	i
tiger	Virginia LL	Numbers	90	0.020	1.0000	i
tiger	Virginia LL	Numbers	91	0.041	0.7039	i
tiger	Virginia LL	Numbers	92	0.011	1.0000	i
tiger	Virginia LL	Numbers	93	0.000	1.0000	i
tiger	Virginia LL	Numbers	95	0.029	0.5538	i
tiger	Virginia LL	Numbers	96	0.009	1.0000	i
tiger	Virginia LL	Numbers	97	0.028	0.5560	i
tiger	SC LL	Numbers	83	1.08	1.00000	i,5
tiger	SC LL	Numbers	94	1.93	1.00000	i
tiger	SC LL	Numbers	95	1.29	1.00000	i
tiger	SHARK Observer	Numbers	94	0.424	1.00000	c,4
tiger	SHARK Observer	Numbers	95	0.399	1.00000	c
tiger	SHARK Observer	Numbers	96	0.429	1.00000	c
tiger	SHARK Observer	Numbers	97	0.639	1.00000	c
tiger	pelagic logbook	Numbers	86	0.582	0.3047	c,8
tiger	pelagic logbook	Numbers	87	0.346	0.2688	c
tiger	pelagic logbook	Numbers	88	0.327	0.2859	c
tiger	pelagic logbook	Numbers	89	0.388	0.2376	c
tiger	pelagic logbook	Numbers	90	0.517	0.1761	c
tiger	pelagic logbook	Numbers	91	0.429	0.1900	c
tiger	pelagic logbook	Numbers	92	0.192	0.2080	c
tiger	pelagic logbook	Numbers	93	0.227	0.1775	c
tiger	pelagic logbook	Numbers	94	0.234	0.1614	c
tiger	pelagic logbook	Numbers	95	0.227	0.1762	c
tiger	pelagic logbook	Numbers	96	0.189	0.2172	c
tiger	pelagic logbook	Numbers	97	0.187	0.2064	c
(tiger	NMFS LL NE	Numbers	86	0.267	0.4630	i),12
tiger	NMFS LL NE	Numbers	89	0.275	0.3219	i
tiger	NMFS LL NE	Numbers	91	0.302	0.3563	i
tiger	NMFS LL NE	Numbers	96	0.146	0.4737	i
tiger	NMFS LL NE	Numbers	98	0.528	0.4601	i
tiger	NMFS LL SE	Numbers	95	0.512	0.194	i,13
tiger	NMFS LL SE	Numbers	96	0.071	0.337	i
tiger	NMFS LL SE	Numbers	97	0.216	0.172	i
sand tiger	Virginia LL	Numbers	74	0.179	1.0000	i,6
sand tiger	Virginia LL	Numbers	75	0.259	0.7470	i
sand tiger	Virginia LL	Numbers	76	0.583	0.6587	i
sand tiger	Virginia LL	Numbers	77	0.000	1.0000	i
sand tiger	Virginia LL	Numbers	78	0.000	1.0000	i
sand tiger	Virginia LL	Numbers	79	3.333	1.0000	i
sand tiger	Virginia LL	Numbers	80	0.262	0.5566	i
sand tiger	Virginia LL	Numbers	81	0.142	0.6936	i
sand tiger	Virginia LL	Numbers	82	0.781	1.0000	i

sand tiger	Virginia LL	Numbers	83	0.103	1.0000	i
sand tiger	Virginia LL	Numbers	84	0.163	1.0000	i
sand tiger	Virginia LL	Numbers	85	0.000	1.0000	i
sand tiger	Virginia LL	Numbers	86	0.222	1.0000	i
sand tiger	Virginia LL	Numbers	87	0.000	1.0000	i
sand tiger	Virginia LL	Numbers	88	0.106	1.0000	i
sand tiger	Virginia LL	Numbers	89	0.066	1.0000	i
sand tiger	Virginia LL	Numbers	90	0.050	0.4714	i
sand tiger	Virginia LL	Numbers	91	0.094	0.4782	i
sand tiger	Virginia LL	Numbers	92	0.117	0.7795	i
sand tiger	Virginia LL	Numbers	93	0.045	0.6851	i
sand tiger	Virginia LL	Numbers	95	0.029	0.5538	i
sand tiger	Virginia LL	Numbers	96	0.037	0.5686	i
sand tiger	Virginia LL	Numbers	97	0.000	1.0000	i
sand tiger	MRFSS,HBOAT,TX1	Numbers	81	2.35	1.00000	r,9
sand tiger	MRFSS,HBOAT,TX1	Numbers	82	11.92	1.00000	r
sand tiger	MRFSS,HBOAT,TX1	Numbers	83	11.98	1.00000	r
sand tiger	MRFSS,HBOAT,TX1	Numbers	84	2.34	1.00000	r
sand tiger	MRFSS,HBOAT,TX1	Numbers	85	2.97	1.00000	r
sand tiger	MRFSS,HBOAT,TX1	Numbers	86	2.28	1.00000	r
sand tiger	MRFSS,HBOAT,TX1	Numbers	87	1.79	1.00000	r
sand tiger	MRFSS,HBOAT,TX1	Numbers	88	0.13	1.00000	r
sand tiger	MRFSS,HBOAT,TX1	Numbers	89	0.41	1.00000	r
sand tiger	MRFSS,HBOAT,TX1	Numbers	90	0.043	1.00000	r
sand tiger	MRFSS,HBOAT,TX1	Numbers	91	0.030	1.00000	r
sand tiger	MRFSS,HBOAT,TX1	Numbers	92	0.12	1.00000	r
sand tiger	MRFSS,HBOAT,TX2	Numbers	93	0.92	1.00000	r,9
sand tiger	MRFSS,HBOAT,TX2	Numbers	94	0.005	1.00000	r
sand tiger	MRFSS,HBOAT,TX2	Numbers	95	0.19	1.00000	r
night	pelagic logbook	Numbers	92	0.100	0.3644	c,8
night	pelagic logbook	Numbers	93	0.109	0.3455	c
night	pelagic logbook	Numbers	94	0.061	0.4338	c
night	pelagic logbook	Numbers	95	0.090	0.2957	c
night	pelagic logbook	Numbers	96	0.055	0.4553	c
night	pelagic logbook	Numbers	97	0.086	0.2666	c
silky	pelagic logbook	Numbers	92	0.327	0.3589	c,8
silky	pelagic logbook	Numbers	93	0.200	0.4455	c
silky	pelagic logbook	Numbers	94	0.209	0.4341	c
silky	pelagic logbook	Numbers	95	0.279	0.3208	c
silky	pelagic logbook	Numbers	96	0.181	0.4925	c
silky	pelagic logbook	Numbers	97	0.091	0.8309	c
hammerhead	pelagic logbook	Numbers	86	2.634	0.2884	c,8
hammerhead	pelagic logbook	Numbers	87	1.482	0.2083	c
hammerhead	pelagic logbook	Numbers	88	2.264	0.1603	c
hammerhead	pelagic logbook	Numbers	89	1.621	0.1660	c
hammerhead	pelagic logbook	Numbers	90	1.675	0.1663	c
hammerhead	pelagic logbook	Numbers	91	1.004	0.2259	c
hammerhead	pelagic logbook	Numbers	92	1.194	0.1108	c
hammerhead	pelagic logbook	Numbers	93	0.824	0.1357	c
hammerhead	pelagic logbook	Numbers	94	0.681	0.1353	c
hammerhead	pelagic logbook	Numbers	95	0.495	0.1705	c
hammerhead	pelagic logbook	Numbers	96	0.510	0.1886	c
hammerhead	pelagic logbook	Numbers	97	0.351	0.2272	c
hammerhead	LPS	Numbers	86	5.49	1.00000	r,11
hammerhead	LPS	Numbers	87	3.41	1.00000	r
hammerhead	LPS	Numbers	88	0.85	1.00000	r
hammerhead	LPS	Numbers	89	3.34	1.00000	r
hammerhead	LPS	Numbers	90	2.47	1.00000	r
hammerhead	LPS	Numbers	91	6.03	1.00000	r
hammerhead	LPS	Numbers	92	2.10	1.00000	r
hammerhead	LPS	Numbers	93	0.69	1.00000	r
hammerhead	LPS	Numbers	94	1.12	1.00000	r
hammerhead	LPS	Numbers	95	0.00	1.00000	r
hammerhead	LPS	Numbers	96	1.06	1.00000	r
hammerhead	LPS	Numbers	97	0.33	1.00000	r

hammerhead	MRFSS,HBOAT,TX1	Numbers	81	1.02	1.00000	r,9
hammerhead	MRFSS,HBOAT,TX1	Numbers	82	11.43	1.00000	r
hammerhead	MRFSS,HBOAT,TX1	Numbers	83	14.51	1.00000	r
hammerhead	MRFSS,HBOAT,TX1	Numbers	84	10.28	1.00000	r
hammerhead	MRFSS,HBOAT,TX1	Numbers	85	8.40	1.00000	r
hammerhead	MRFSS,HBOAT,TX1	Numbers	86	2.97	1.00000	r
hammerhead	MRFSS,HBOAT,TX1	Numbers	87	1.86	1.00000	r
hammerhead	MRFSS,HBOAT,TX1	Numbers	88	1.79	1.00000	r
hammerhead	MRFSS,HBOAT,TX1	Numbers	89	1.48	1.00000	r
hammerhead	MRFSS,HBOAT,TX1	Numbers	90	3.18	1.00000	r
hammerhead	MRFSS,HBOAT,TX1	Numbers	91	4.39	1.00000	r
hammerhead	MRFSS,HBOAT,TX1	Numbers	92	2.39	1.00000	r

hammerhead	MRFSS,HBOAT,TX2	Numbers	93	3.90	1.00000	r,9
hammerhead	MRFSS,HBOAT,TX2	Numbers	94	1.41	1.00000	r
hammerhead	MRFSS,HBOAT,TX2	Numbers	95	2.22	1.00000	r

(sc hammerh	NMFS LL NE	Numbers	86	0.229	0.381	i),12
sc hammerh	NMFS LL NE	Numbers	89	0.783	0.291	i
sc hammerh	NMFS LL NE	Numbers	91	0.462	0.460	i
sc hammerh	NMFS LL NE	Numbers	96	0.008	0.148	i
sc hammerh	NMFS LL NE	Numbers	98	0.030	0.214	i

pelagic sharks	pelagic logbook	Numbers	86	12.348	0.2285	c,8
pelagic sharks	pelagic logbook	Numbers	87	8.053	0.1005	c
pelagic sharks	pelagic logbook	Numbers	88	5.740	0.1098	c
pelagic sharks	pelagic logbook	Numbers	89	4.946	0.1013	c
pelagic sharks	pelagic logbook	Numbers	90	5.583	0.0996	c
pelagic sharks	pelagic logbook	Numbers	91	5.743	0.0994	c
pelagic sharks	pelagic logbook	Numbers	92	3.871	0.0683	c
pelagic sharks	pelagic logbook	Numbers	93	3.561	0.0725	c
pelagic sharks	pelagic logbook	Numbers	94	3.200	0.0724	c
pelagic sharks	pelagic logbook	Numbers	95	3.066	0.0687	c
pelagic sharks	pelagic logbook	Numbers	96	3.655	0.0700	c
pelagic sharks	pelagic logbook	Numbers	97	3.934	0.0664	c

blue	Japanese obs	Numbers	78	2.43	0.22000	c,3
blue	Japanese obs	Numbers	79	1.77	0.19000	c
blue	Japanese obs	Numbers	80	1.55	0.17000	c
blue	Japanese obs	Numbers	81	1.09	0.18000	c
blue	Japanese obs	Numbers	82	0.45	0.40000	c
blue	Japanese obs	Numbers	83	1.08	0.35000	c
blue	Japanese obs	Numbers	84	1.89	0.23000	c
blue	Japanese obs	Numbers	85	1.62	0.22000	c
blue	Japanese obs	Numbers	86	1.34	0.24000	c
blue	Japanese obs	Numbers	87	1.00	0.27000	c
blue	Japanese obs	Numbers	88	0.40	0.58000	c

blue	pelagic logbook	Numbers	86	8.689	0.2425	c,8
blue	pelagic logbook	Numbers	87	4.576	0.1362	c
blue	pelagic logbook	Numbers	88	3.365	0.1426	c
blue	pelagic logbook	Numbers	89	2.252	0.1537	c
blue	pelagic logbook	Numbers	90	2.981	0.1318	c
blue	pelagic logbook	Numbers	91	2.912	0.1341	c
blue	pelagic logbook	Numbers	92	1.960	0.1077	c
blue	pelagic logbook	Numbers	93	1.933	0.1132	c
blue	pelagic logbook	Numbers	94	1.832	0.1079	c
blue	pelagic logbook	Numbers	95	1.701	0.1054	c
blue	pelagic logbook	Numbers	96	2.124	0.1026	c
blue	pelagic logbook	Numbers	97	2.207	0.1030	c

blue	LPS	Numbers	86	77.50	0.219	r,11
blue	LPS	Numbers	87	45.24	0.362	r
blue	LPS	Numbers	88	90.36	0.231	r
blue	LPS	Numbers	89	50.44	0.292	r
blue	LPS	Numbers	90	58.68	0.278	r
blue	LPS	Numbers	91	118.31	0.190	r
blue	LPS	Numbers	92	147.92	0.178	r
blue	LPS	Numbers	93	132.81	0.213	r
blue	LPS	Numbers	94	160.32	0.189	r
blue	LPS	Numbers	95	140.95	0.235	r
blue	LPS	Numbers	96	434.28	0.181	r

blue	LPS	Numbers	97	311.75	0.187	r
mako	Japanese obs	Numbers	78	0.60	0.19000	c,3
mako	Japanese obs	Numbers	79	0.42	0.19000	c
mako	Japanese obs	Numbers	80	0.36	0.18000	c
mako	Japanese obs	Numbers	81	0.30	0.19000	c
mako	Japanese obs	Numbers	82	0.16	0.44000	c
mako	Japanese obs	Numbers	83	0.22	0.40000	c
mako	Japanese obs	Numbers	84	0.30	0.25000	c
mako	Japanese obs	Numbers	85	0.23	0.25000	c
mako	Japanese obs	Numbers	86	0.27	0.27000	c
mako	Japanese obs	Numbers	87	0.26	0.30000	c
mako	Japanese obs	Numbers	88	0.17	0.65000	c
mako	pelagic logbook	Numbers	86	1.385	0.1802	c,8
mako	pelagic logbook	Numbers	87	0.817	0.1503	c
mako	pelagic logbook	Numbers	88	0.596	0.1775	c
mako	pelagic logbook	Numbers	89	0.700	0.1496	c
mako	pelagic logbook	Numbers	90	0.503	0.1946	c
mako	pelagic logbook	Numbers	91	0.525	0.1741	c
mako	pelagic logbook	Numbers	92	0.493	0.1074	c
mako	pelagic logbook	Numbers	93	0.360	0.1347	c
mako	pelagic logbook	Numbers	94	0.357	0.3630	c
mako	pelagic logbook	Numbers	95	0.363	0.1196	c
mako	pelagic logbook	Numbers	96	0.324	0.1419	c
mako	pelagic logbook	Numbers	97	0.370	0.1221	c
mako	weighout	Biomass	85	60.84	0.11800	c,3
mako	weighout	Biomass	86	76.87	0.08800	c
mako	weighout	Biomass	87	55.63	0.06600	c
mako	weighout	Biomass	88	53.03	0.05900	c
mako	weighout	Biomass	89	49.57	0.06400	c
mako	weighout	Biomass	90	41.70	0.06400	c
mako	weighout	Biomass	91	38.12	0.05600	c
mako	weighout	Biomass	92	24.47	0.05300	c
mako	weighout	Biomass	93	32.73	0.04400	c
mako	LPS	Numbers	86	40.44	0.187	r,11
mako	LPS	Numbers	87	26.67	0.268	r
mako	LPS	Numbers	88	11.10	0.510	r
mako	LPS	Numbers	89	17.98	0.354	r
mako	LPS	Numbers	90	20.53	0.316	r
mako	LPS	Numbers	91	33.35	0.212	r
mako	LPS	Numbers	92	31.83	0.226	r
mako	LPS	Numbers	93	32.99	0.268	r
mako	LPS	Numbers	94	29.61	0.257	r
mako	LPS	Numbers	95	27.34	0.275	r
mako	LPS	Numbers	96	32.67	0.254	r
mako	LPS	Numbers	97	40.28	0.226	r
thresher	pelagic logbook	Numbers	86	0.284	0.5853	c,8
thresher	pelagic logbook	Numbers	87	0.430	0.2474	c
thresher	pelagic logbook	Numbers	88	0.383	0.2872	c
thresher	pelagic logbook	Numbers	89	0.414	0.2364	c
thresher	pelagic logbook	Numbers	90	0.389	0.2431	c
thresher	pelagic logbook	Numbers	91	0.325	0.2701	c
thresher	pelagic logbook	Numbers	92	0.348	0.1642	c
thresher	pelagic logbook	Numbers	93	0.210	0.2267	c
thresher	pelagic logbook	Numbers	94	0.136	0.3126	c
thresher	pelagic logbook	Numbers	95	0.150	0.2684	c
thresher	pelagic logbook	Numbers	96	0.174	0.2515	c
thresher	pelagic logbook	Numbers	97	0.185	0.2351	c
thresher	weighout	Biomass	85	2.21	0.60200	c,3
thresher	weighout	Biomass	86	3.10	0.33300	c
thresher	weighout	Biomass	87	4.08	0.19700	c
thresher	weighout	Biomass	88	8.80	0.16600	c
thresher	weighout	Biomass	89	2.72	0.23800	c
thresher	weighout	Biomass	90	2.19	0.24400	c
thresher	weighout	Biomass	91	1.23	0.24500	c
thresher	weighout	Biomass	92	1.67	0.17500	c
thresher	weighout	Biomass	93	4.76	0.13500	c

ocean whitetip	pelagic logbook	Numbers	92	0.082	0.1987	c,8
ocean whitetip	pelagic logbook	Numbers	93	0.079	0.1789	c
ocean whitetip	pelagic logbook	Numbers	94	0.077	0.1623	c
ocean whitetip	pelagic logbook	Numbers	95	0.061	0.1480	c
ocean whitetip	pelagic logbook	Numbers	96	0.082	0.1600	c
ocean whitetip	pelagic logbook	Numbers	97	0.094	0.1597	c
small coastal	SC LL	Numbers	83	1.81	1.00000	i,5
small coastal	SC LL	Numbers	94	2.22	1.00000	i
small coastal	SC LL	Numbers	95	1.75	1.00000	i
small coastals	Oregon II	Numbers	72	0.565	0.260	i,14
small coastals	Oregon II	Numbers	73	1.009	0.182	i
small coastals	Oregon II	Numbers	74	1.881	0.175	i
small coastals	Oregon II	Numbers	75	1.544	0.161	i
small coastals	Oregon II	Numbers	76	1.612	0.143	i
small coastals	Oregon II	Numbers	77	0.909	0.206	i
small coastals	Oregon II	Numbers	78	0.796	0.193	i
small coastals	Oregon II	Numbers	79	0.987	0.211	i
small coastals	Oregon II	Numbers	80	1.449	0.202	i
small coastals	Oregon II	Numbers	81	0.882	0.228	i
small coastals	Oregon II	Numbers	82	0.952	0.199	i
small coastals	Oregon II	Numbers	83	0.790	0.234	i
small coastals	Oregon II	Numbers	84	0.664	0.365	i
small coastals	Oregon II	Numbers	85	1.069	0.344	i
small coastals	Oregon II	Numbers	86	1.067	0.562	i
small coastals	Oregon II	Numbers	87	4.655	0.911	i
small coastals	Oregon II	Numbers	88	0.269	0.456	i
small coastals	Oregon II	Numbers	89	0.410	0.686	i
small coastals	Oregon II	Numbers	90	0.164	0.454	i
small coastals	Oregon II	Numbers	91	0.201	0.472	i
small coastals	Oregon II	Numbers	92	0.188	0.484	i
small coastals	Oregon II	Numbers	93	0.327	0.485	i
small coastals	Oregon II	Numbers	94	1.097	0.415	i
small coastals	Oregon II	Numbers	95	0.495	0.551	i
small coastals	Oregon II	Numbers	96	0.276	0.487	i
small coastals	Oregon II	Numbers	97	0.600	0.546	i
sharpnose	Oregon II	Numbers	72	0.400	0.341	i,14
sharpnose	Oregon II	Numbers	73	0.409	0.255	i
sharpnose	Oregon II	Numbers	74	1.693	0.194	i
sharpnose	Oregon II	Numbers	75	1.283	0.178	i
sharpnose	Oregon II	Numbers	76	1.213	0.151	i
sharpnose	Oregon II	Numbers	77	0.632	0.200	i
sharpnose	Oregon II	Numbers	78	0.686	0.204	i
sharpnose	Oregon II	Numbers	79	0.798	0.208	i
sharpnose	Oregon II	Numbers	80	1.334	0.210	i
sharpnose	Oregon II	Numbers	81	0.845	0.235	i
sharpnose	Oregon II	Numbers	82	0.889	0.210	i
sharpnose	Oregon II	Numbers	83	0.727	0.249	i
sharpnose	Oregon II	Numbers	84	0.663	0.365	i
sharpnose	Oregon II	Numbers	85	1.034	0.355	i
sharpnose	Oregon II	Numbers	86	0.300	0.562	i
sharpnose	Oregon II	Numbers	87	4.655	0.911	i
sharpnose	Oregon II	Numbers	88	0.219	0.403	i
sharpnose	Oregon II	Numbers	89	0.410	0.686	i
sharpnose	Oregon II	Numbers	90	0.109	0.529	i
sharpnose	Oregon II	Numbers	91	0.188	0.492	i
sharpnose	Oregon II	Numbers	92	0.188	0.484	i
sharpnose	Oregon II	Numbers	93	0.278	0.517	i
sharpnose	Oregon II	Numbers	94	1.082	0.421	i
sharpnose	Oregon II	Numbers	95	0.477	0.572	i
sharpnose	Oregon II	Numbers	96	0.229	0.577	i
sharpnose	Oregon II	Numbers	97	0.600	0.546	i
sharpnose	Virginia LL	Numbers	74	0.250	1.0000	i,6
sharpnose	Virginia LL	Numbers	75	0.692	0.8958	i
sharpnose	Virginia LL	Numbers	76	0.202	1.0000	i
sharpnose	Virginia LL	Numbers	77	1.588	0.5488	i
sharpnose	Virginia LL	Numbers	78	0.000	1.0000	i
sharpnose	Virginia LL	Numbers	79	0.000	1.0000	i
sharpnose	Virginia LL	Numbers	80	0.764	0.4224	i

sharpnose	Virginia LL	Numbers	81	0.757	0.2530	i
sharpnose	Virginia LL	Numbers	82	0.000	1.0000	i
sharpnose	Virginia LL	Numbers	83	0.570	0.6566	i
sharpnose	Virginia LL	Numbers	84	0.000	1.0000	i
sharpnose	Virginia LL	Numbers	85	0.000	1.0000	i
sharpnose	Virginia LL	Numbers	86	0.000	1.0000	i
sharpnose	Virginia LL	Numbers	87	0.403	0.8020	i
sharpnose	Virginia LL	Numbers	88	0.433	0.6424	i
sharpnose	Virginia LL	Numbers	89	0.213	0.3378	i
sharpnose	Virginia LL	Numbers	90	0.643	0.5051	i
sharpnose	Virginia LL	Numbers	91	0.553	0.4531	i
sharpnose	Virginia LL	Numbers	92	0.879	0.4147	i
sharpnose	Virginia LL	Numbers	93	0.939	0.3447	i
sharpnose	Virginia LL	Numbers	95	1.026	0.2635	i
sharpnose	Virginia LL	Numbers	96	0.592	0.3252	i
sharpnose	Virginia LL	Numbers	97	0.373	0.3963	i
sharpnose	SC LL	Numbers	83	0.84	1.00000	i,5
sharpnose	SC LL	Numbers	94	1.96	1.00000	i
sharpnose	SC LL	Numbers	95	1.71	1.00000	i
(sharpnose	NMFS LL NE	Numbers	86	0.650	0.365	i),12
sharpnose	NMFS LL NE	Numbers	89	0.054	0.173	i
sharpnose	NMFS LL NE	Numbers	91	0.164	0.297	i
sharpnose	NMFS LL NE	Numbers	96	0.015	0.212	i
sharpnose	NMFS LL NE	Numbers	98	0.071	0.356	i
bonnethead	Oregon II	Numbers	72	1.64	0.36000	i,14
bonnethead	Oregon II	Numbers	73	5.48	0.25000	i
bonnethead	Oregon II	Numbers	74	2.99	0.25000	i
bonnethead	Oregon II	Numbers	75	1.63	0.43000	i
bonnethead	Oregon II	Numbers	76	3.28	0.25000	i
bonnethead	Oregon II	Numbers	77	2.60	0.50000	i
bonnethead	Oregon II	Numbers	78	1.09	0.38000	i
bonnethead	Oregon II	Numbers	79	1.88	0.67000	i
bonnethead	Oregon II	Numbers	80	0.86	0.52000	i
bonnethead	Oregon II	Numbers	81	0.37	0.49000	i
bonnethead	Oregon II	Numbers	82	0.48	0.40000	i
bonnethead	Oregon II	Numbers	83	0.63	0.56000	i
bonnethead	Oregon II	Numbers	84	0.00	1.00000	i
bonnethead	Oregon II	Numbers	85	0.34	1.00000	i
bonnethead	Oregon II	Numbers	86	0.00	1.00000	i
bonnethead	Oregon II	Numbers	87	0.00	1.00000	i
bonnethead	Oregon II	Numbers	88	0.51	1.00000	i
bonnethead	Oregon II	Numbers	89	0.000	1.00000	i
bonnethead	Oregon II	Numbers	90	0.000	1.00000	i
bonnethead	Oregon II	Numbers	91	0.000	1.00000	i
bonnethead	Oregon II	Numbers	92	0.000	1.00000	i
bonnethead	Oregon II	Numbers	93	0.488	1.00000	i
bonnethead	Oregon II	Numbers	94	0.000	1.00000	i
bonnethead	Oregon II	Numbers	95	0.000	1.00000	i
bonnethead	Oregon II	Numbers	96	0.286	1.00000	i
bonnethead	Oregon II	Numbers	97	0.000	1.00000	i

Sources:

c -- commercial fishery catch rates
r -- recreational fishery catch rates
i -- fishery-independent resource survey catch rates
1 -- SB-III-22
2 -- SB-III-13
3 -- see 1994, 1995 & 1996 Shark Evaluation reports; also SB-III-15, 16
4 -- SB-IV-2
5 -- SB-III-9
6 -- SB-IV-13
7 -- SB-III-19
8 -- SB-IV-11
9 -- SB-III-5
10 -- SB-IV-18
11 -- SB-IV-5
12 -- NMFS/NEFSC unpublished analyses
13 -- SB-IV-29
14 -- SB-IV-30

APPENDIX 2. Production Model Analyses and Projections

Prior Distributions for each stock grouping.

		Parameters		
Grouping	r	K	Co	z
Large Coastals	Lognormal Mean=0.113 SD=0.7	P(K) proportional to 1/K	Lognormal Mean=487.3 SD=0.51	Lognormal Mean=1 SD=0.2
Sandbar shark	Lognormal Mean=0.117 SD=0.7	P(K) proportional to 1/K	Lognormal Mean=135.9 SD=0.53	Lognormal Mean=1 SD=0.2
Blacktip shark	Lognormal Mean=0.136 SD=0.7	P(K) proportional to 1/K	Lognormal Mean=303.8 SD=0.43	Lognormal Mean=1 SD=0.2

r: intrinsic rate of increase; K: carrying capacity; Co: average catch from 1974 to year before first observed catch; z: ratio of abundance in 1974 to K
First year observed catch is 1981 for Large Coastal Sharks and 1986 for sandbar and blacktip sharks.

In the next three tables, sigma is the square root of the variance for each CPUE series; Q is the catchability coefficient.

LC Baseline / **LC Alternative Catch**

Name	Sigma	Q	Sigma	Q
Brannon	0.3073	5.27E-02		3.82E-02
Hudson	0.6709	1.38E-05		1.00E-05
Crooke	0.2605	1.78E-05		1.34E-05
Shark Observer	0.3460	1.55E-03		1.14E-03
Jax	0.4161	7.07E-05		5.29E-05
NC #	0.3066	2.76E-01		1.97E-01
SC LL	0.0750	9.31E-04		7.06E-04
Pt Salerno	0.6589	4.63E-05		3.46E-05
Tampa Bay	0.5388	1.50E-05		1.08E-05
Va LL	0.5604	2.51E-04		1.88E-04
LPS	0.5483	7.82E-03		5.76E-03
Charter Boat	0.2233	1.17E-01		8.87E-02
Pelagic log	0.1616	2.13E-03		1.57E-03
Early Rec	0.2513	8.90E-04		6.58E-04
Late Rec	0.1337	1.12E-03		8.30E-04
NMFS LL NE	0.4599	8.64E-04		6.15E-04
NMFS LL SE	0.3788	4.96E-04		3.56E-04

Sandbar Baseline / **Sandbar Alt Catch**

Name	Sigma	Q	Sigma	Q
Va LL	0.6966	4.41E-04	0.7003	4.15E-04
Pelagic Logs	0.5126	2.50E-03	0.4858	2.48E-03
Early Rec	0.6614	5.60E-04	0.6641	4.97E-04
Late Rec	0.3938	4.01E-04	0.3598	4.01E-04
NMFS LL NE	0.5160	1.33E-03	0.4776	1.23E-03
NMFS LL SE	0.2857	2.53E-04	0.2810	2.47E-04

SC LL	0.7701	8.03E-04	0.7013	7.84E-04
Shark Observer	0.7184	1.57E-03	0.6864	1.56E-03

Blacktip Baseline			Blacktip Alt Catch	
Name	Sigma	Q	Sigma	Q
pelagic log	0.1121	9.53E-04	0.1228	8.77E-04
Early Rec	0.5972	4.50E-03	0.6230	3.60E-03
Late Rec	0.1441	7.18E-03	0.1370	6.65E-03
Shark Observer	0.6071	2.08E-04	0.6060	1.92E-04
NMFS LL NE	0.4851	4.85E-05	0.4942	4.20E-05
NMFS LL SE	0.3050	1.56E-04	0.3003	1.44E-04
Gulf Logs	1.0981	4.57E-02	1.0885	4.23E-02

The next sets of tables show 10, 20, and 30-yr projections for several alternative total allowable catch (TAC) policies (0 catch, 10%, 20%, 30%, 40%, and 50% of the 1995 catch). Nfin/K is the ratio of stock size at the end of the projection to carrying capacity (K). Also shown is the probability that stock size will be less than 20% of K (Nfin<0.2K), more than 50% of K (Nfin>0.5K), and higher than the 1998 stock size (Nfin>N98).

Large Coastals Baseline

	f=%C95	Nfin/K	P(Nfin<0.2K)	P(Nfin>0.5K)	P(Nfin>N98)
10-year	0	0.23	0.42	0.00	1.00
	10	0.18	0.68	0.00	0.66
	20	0.12	0.88	0.00	0.21
	30	0.07	0.97	0.00	0.03
	40	0.03	1.00	0.00	0.00
	50	0.01	1.00	0.00	0.00
20 -year	0	0.36	0.14	0.20	1.00
	10	0.25	0.46	0.07	0.74
	20	0.11	0.82	0.02	0.24
	30	0.03	0.97	0.00	0.04
	40	0.01	1.00	0.00	0.00
	50	0.01	1.00	0.00	0.00
30 -year	0	0.50	0.04	0.46	1.00
	10	0.33	0.37	0.23	0.76
	20	0.12	0.78	0.07	0.24
	30	0.03	0.96	0.01	0.04
	40	0.01	1.00	0.00	0.00
	50	0.01	1.00	0.00	0.00

Large Coastals Alt Catch

Horizon	f=%C95	Nfin/K	P(Nfin<0.2K)	P(Nfin>0.5K)	P(Nfin>N98)
10 -year	0	0.25	0.26	0.01	1.00
	10	0.22	0.49	0.00	0.76
	20	0.17	0.71	0.00	0.30
	30	0.13	0.86	0.00	0.10

	40	0.09	0.95	0.00	0.04
	50	0.07	0.98	0.00	0.03
20 -year	0	0.36	0.07	0.15	1.00
	10	0.27	0.33	0.08	0.82
	20	0.18	0.67	0.02	0.35
	30	0.10	0.86	0.01	0.15
	40	0.09	0.90	0.00	0.13
	50	0.09	0.89	0.01	0.12
30 -year	0	0.47	0.03	0.39	1.00
	10	0.34	0.25	0.19	0.84
	20	0.18	0.65	0.08	0.36
	30	0.11	0.80	0.03	0.21
	40	0.15	0.72	0.03	0.33
	50	0.29	0.31	0.06	0.75

Sandbar Baseline

Horizon	f=%C95	Nfin/K	P(Nfin<0.2K)	P(Nfin>0.5K)	P(Nfin>N98)
10 -year	0	0.48	0.05	0.41	1.00
	10	0.45	0.09	0.36	0.98
	20	0.41	0.14	0.31	0.88
	30	0.38	0.19	0.26	0.70
	40	0.34	0.27	0.22	0.54
	50	0.30	0.36	0.17	0.41
20 -year	0	0.64	0.02	0.71	1.00
	10	0.59	0.05	0.61	0.98
	20	0.52	0.11	0.52	0.89
	30	0.45	0.20	0.42	0.72
	40	0.38	0.32	0.33	0.55
	50	0.31	0.45	0.26	0.41
30 -year	0	0.75	0.00	0.85	1.00
	10	0.68	0.03	0.75	0.99
	20	0.60	0.09	0.64	0.90
	30	0.50	0.20	0.51	0.73
	40	0.40	0.35	0.40	0.55
	50	0.31	0.49	0.31	0.41

Sandbar **Alt Catch**

Horizon	f=%C95	Nfin/K	P(Nfin<0.2K)	P(Nfin>0.5K)	P(Nfin>N98)
10 -year	0	0.66	0.02	0.70	1.00
	10	0.64	0.03	0.67	1.00
	20	0.61	0.05	0.64	0.97
	30	0.58	0.08	0.59	0.90
	40	0.55	0.12	0.53	0.82
	50	0.52	0.16	0.50	0.74

20 -year	0	0.80	0.01	0.86	1.00
	10	0.77	0.01	0.82	1.00
	20	0.72	0.04	0.76	0.97
	30	0.68	0.07	0.72	0.91
	40	0.63	0.13	0.68	0.83
	50	0.58	0.18	0.61	0.74
30 -year	0	0.87	0.00	0.94	1.00
	10	0.83	0.01	0.89	1.00
	20	0.78	0.03	0.84	0.98
	30	0.73	0.07	0.79	0.91
	40	0.67	0.14	0.72	0.83
	50	0.60	0.21	0.67	0.74

Blacktip Baseline

Horizon	f=%C95	Nfin/K	P(Nfin<0.2K)	P(Nfin>0.5K)	P(Nfin>N98)
10 -year	0	0.45	0.08	0.36	1.00
	10	0.41	0.15	0.29	0.94
	20	0.35	0.26	0.21	0.71
	30	0.28	0.39	0.12	0.48
	40	0.22	0.53	0.09	0.29
	50	0.17	0.65	0.06	0.16
20 -year	0	0.64	0.02	0.69	1.00
	10	0.56	0.09	0.56	0.96
	20	0.45	0.22	0.42	0.75
	30	0.34	0.40	0.30	0.51
	40	0.22	0.59	0.17	0.31
	50	0.14	0.74	0.10	0.16
30 -year	0	0.77	0.01	0.86	1.00
	10	0.66	0.06	0.71	0.96
	20	0.52	0.21	0.54	0.75
	30	0.37	0.42	0.38	0.52
	40	0.23	0.62	0.22	0.31
	50	0.13	0.79	0.13	0.17

Blacktip Alt Catch

Horizon	f=%C95	Nfin/K	P(Nfin<0.2K)	P(Nfin>0.5K)	P(Nfin>N98)
10 -year	0	0.41	0.10	0.27	1.00
	10	0.38	0.18	0.24	0.95
	20	0.33	0.29	0.17	0.73
	30	0.27	0.41	0.13	0.52
	40	0.22	0.53	0.06	0.33
	50	0.16	0.63	0.04	0.21
20 -year	0	0.61	0.02	0.62	1.00
	10	0.53	0.09	0.51	0.97

	20	0.44	0.23	0.38	0.76
	30	0.34	0.39	0.28	0.54
	40	0.24	0.56	0.19	0.34
	50	0.17	0.70	0.14	0.23
30 -year	0	0.73	0.00	0.79	1.00
	10	0.64	0.06	0.67	0.97
	20	0.52	0.20	0.52	0.77
	30	0.38	0.39	0.37	0.55
	40	0.26	0.62	0.26	0.35
	50	0.17	0.75	0.17	0.23

The next sets of tables show 10, 20, and 30-yr projections for several alternative total allowable catch (TAC) policies (0 catch, 10%, 20%, 30%, 40%, and 50% of the 1995 catch) grouped (binned) by r interval. E[cat/yr] is the expected catch; E[N 2008 in k], etc., is the expected stock sizes in thousands of individuals; E[N 2008/K], etc., is the ratio of the expected stock size to K; P[Extinct] is the probability that the stock will become extinct; P[Nfin<0.2K] is the probability that stock size will be less than 20% of K; P[Nfin>MSYL] is the probability that stock size will be higher than the Maximum Sustainable Yield (MSY) level; P[Nfin>Ncur] is the probability that stock size will be higher than the current stock size; P[N98>N93] is the probability that the 1998 stock size will be higher than the 1993 stock size; and E[T(MSYL)|recov] is the expected time to reach the MSY level given recovery.

Large Coastals **Baseline** Cond on r

E[cat/yr] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	2.51E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.45E+00
10	6.45E+01	3.95E+00	3.95E+00	3.95E+00	3.95E+00	3.95E+00	1.95E+01
20	1.04E+02	7.85E+00	7.85E+00	7.89E+00	7.89E+00	7.89E+00	3.26E+01
30	1.36E+02	9.27E+00	9.48E+00	9.94E+00	1.05E+01	1.18E+01	4.19E+01
40	1.49E+02	5.45E+00	5.79E+00	5.97E+00	1.13E+01	7.89E+00	4.26E+01
50	1.49E+02	2.15E+00	1.63E+00	2.08E+00	3.38E+00	9.87E+00	3.98E+01

E[cat/yr] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	1.31E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.38E+00
10	5.45E+01	2.07E+00	2.07E+00	2.07E+00	2.07E+00	2.07E+00	1.56E+01
20	8.54E+01	3.03E+00	3.67E+00	4.07E+00	4.13E+00	4.13E+00	2.45E+01
30	8.64E+01	9.17E-01	1.71E+00	2.63E+00	5.14E+00	6.20E+00	2.33E+01
40	8.24E+01	4.14E-02	1.99E-01	5.88E-01	1.42E+00	4.13E+00	2.13E+01
50	7.89E+01	0.00E+00	9.95E-03	7.11E-02	5.91E-01	2.58E+00	2.03E+01

E[cat/yr] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	8.89E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E+00
10	5.06E+01	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.41E+01
20	6.52E+01	1.19E+00	2.06E+00	2.53E+00	2.80E+00	2.80E+00	1.80E+01
30	5.91E+01	1.40E-01	4.45E-01	1.40E+00	3.24E+00	3.15E+00	1.55E+01
40	5.59E+01	0.00E+00	2.70E-02	1.29E-01	9.60E-01	2.80E+00	1.44E+01
50	5.35E+01	0.00E+00	0.00E+00	1.61E-02	4.00E-01	1.75E+00	1.38E+01

E[N 2008 in k] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	1.82E+03	2.05E+03	2.26E+03	2.51E+03	2.92E+03	3.42E+03	2.08E+03
10	1.38E+03	1.60E+03	1.79E+03	2.04E+03	2.50E+03	3.06E+03	1.63E+03
20	9.18E+02	1.09E+03	1.22E+03	1.42E+03	1.87E+03	2.49E+03	1.11E+03
30	4.74E+02	5.78E+02	6.37E+02	7.56E+02	1.19E+03	1.83E+03	5.84E+02

40	1.68E+02	2.20E+02	2.46E+02	3.18E+02	5.48E+02	1.14E+03	2.24E+02
50	8.95E+01	1.22E+02	1.23E+02	1.28E+02	2.28E+02	8.16E+02	1.16E+02

E[N 2018 in k] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	2.31E+03	3.13E+03	4.07E+03	4.78E+03	5.17E+03	5.31E+03	3.27E+03
10	1.30E+03	2.00E+03	2.91E+03	3.79E+03	4.53E+03	4.91E+03	2.18E+03
20	3.63E+02	7.51E+02	1.37E+03	2.22E+03	3.39E+03	4.22E+03	9.30E+02
30	3.86E+01	1.07E+02	2.60E+02	6.56E+02	1.75E+03	2.71E+03	1.83E+02
40	7.26E+00	2.05E+01	7.32E+01	1.45E+02	4.55E+02	1.73E+03	4.33E+01
50	5.20E+01	7.99E+01	8.70E+01	8.64E+01	1.56E+02	9.13E+02	7.59E+01

E[N 2028 in k] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	2.90E+03	4.43E+03	5.91E+03	6.36E+03	6.03E+03	5.73E+03	4.52E+03
10	1.19E+03	2.55E+03	4.32E+03	5.43E+03	5.60E+03	5.47E+03	2.84E+03
20	1.38E+02	5.42E+02	1.69E+03	3.28E+03	4.63E+03	5.08E+03	9.47E+02
30	8.52E+00	2.33E+01	1.67E+02	8.09E+02	2.55E+03	3.31E+03	1.38E+02
40	4.92E+00	1.78E+01	5.93E+01	1.29E+02	5.69E+02	2.20E+03	3.84E+01
50	5.16E+01	7.99E+01	8.65E+01	8.19E+01	1.56E+02	1.09E+03	7.55E+01

E[N 2008 / K] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	1.68E-01	2.13E-01	2.69E-01	3.46E-01	4.68E-01	5.87E-01	2.27E-01
10	1.28E-01	1.66E-01	2.14E-01	2.81E-01	4.00E-01	5.25E-01	1.78E-01
20	8.47E-02	1.13E-01	1.45E-01	1.95E-01	3.01E-01	4.27E-01	1.21E-01
30	4.36E-02	6.04E-02	7.62E-02	1.04E-01	1.92E-01	3.12E-01	6.43E-02
40	1.55E-02	2.30E-02	2.94E-02	4.39E-02	8.75E-02	1.93E-01	2.48E-02
50	8.69E-03	1.29E-02	1.46E-02	1.75E-02	3.61E-02	1.38E-01	1.28E-02

E[N 2018 / K] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	2.15E-01	3.27E-01	4.85E-01	6.59E-01	8.26E-01	9.14E-01	3.64E-01
10	1.20E-01	2.09E-01	3.47E-01	5.23E-01	7.24E-01	8.45E-01	2.47E-01
20	3.35E-02	7.88E-02	1.65E-01	3.08E-01	5.45E-01	7.26E-01	1.09E-01
30	3.44E-03	1.12E-02	3.10E-02	9.10E-02	2.81E-01	4.63E-01	2.25E-02
40	8.15E-04	2.40E-03	9.03E-03	2.00E-02	7.25E-02	2.92E-01	5.63E-03
50	5.35E-03	8.54E-03	1.03E-02	1.18E-02	2.45E-02	1.53E-01	8.60E-03

E[N 2028 / K] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	2.70E-01	4.62E-01	7.03E-01	8.74E-01	9.62E-01	9.88E-01	5.02E-01
10	1.11E-01	2.68E-01	5.16E-01	7.47E-01	8.94E-01	9.43E-01	3.26E-01
20	1.26E-02	5.70E-02	2.04E-01	4.54E-01	7.43E-01	8.75E-01	1.16E-01
30	6.66E-04	2.41E-03	1.99E-02	1.13E-01	4.09E-01	5.67E-01	1.85E-02
40	5.79E-04	2.15E-03	7.40E-03	1.78E-02	9.05E-02	3.73E-01	5.12E-03
50	5.31E-03	8.54E-03	1.03E-02	1.12E-02	2.46E-02	1.83E-01	8.55E-03

P[Extinct] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	1.01E-02	5.46E-03	5.78E-03	0.00E+00	0.00E+00	0.00E+00	6.20E-03
30	3.23E-01	2.17E-01	1.99E-01	1.61E-01	1.14E-01	0.00E+00	2.35E-01
40	7.21E-01	6.55E-01	6.33E-01	6.22E-01	2.86E-01	5.00E-01	6.62E-01
50	9.26E-01	8.91E-01	9.17E-01	8.95E-01	8.29E-01	5.00E-01	9.05E-01

P[Extinct] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	4.99E-01	2.67E-01	1.13E-01	1.61E-02	0.00E+00	0.00E+00	2.71E-01
30	9.43E-01	8.52E-01	7.25E-01	5.76E-01	1.71E-01	0.00E+00	8.20E-01
40	9.97E-01	9.95E-01	9.76E-01	9.29E-01	8.29E-01	5.00E-01	9.84E-01
50	9.99E-01	1.00E+00	9.99E-01	9.93E-01	9.43E-01	7.50E-01	9.98E-01

P[Extinct] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	6.92E-02	2.27E-03	9.63E-04	0.00E+00	0.00E+00	0.00E+00	1.90E-02
20	8.63E-01	5.74E-01	2.66E-01	9.63E-02	0.00E+00	0.00E+00	5.38E-01
30	9.97E-01	9.67E-01	8.94E-01	6.67E-01	2.29E-01	2.50E-01	9.28E-01
40	1.00E+00	1.00E+00	9.95E-01	9.77E-01	8.29E-01	5.00E-01	9.95E-01
50	1.00E+00	1.00E+00	1.00E+00	9.98E-01	9.43E-01	7.50E-01	9.99E-01

P[Nfin<0.2K] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	8.04E-01	4.30E-01	1.19E-01	9.17E-03	0.00E+00	0.00E+00	4.22E-01
10	9.25E-01	7.60E-01	4.47E-01	1.31E-01	5.71E-02	0.00E+00	6.77E-01
20	9.83E-01	9.31E-01	7.93E-01	5.71E-01	1.14E-01	0.00E+00	8.78E-01
30	9.96E-01	9.86E-01	9.63E-01	8.35E-01	5.71E-01	5.00E-01	9.68E-01
40	9.99E-01	1.00E+00	9.95E-01	9.79E-01	8.57E-01	5.00E-01	9.96E-01
50	9.99E-01	1.00E+00	1.00E+00	9.93E-01	9.43E-01	7.50E-01	9.99E-01

P[Nfin<0.2K] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	4.76E-01	4.18E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E-01
10	9.05E-01	4.88E-01	7.41E-02	0.00E+00	0.00E+00	0.00E+00	4.63E-01
20	9.93E-01	9.24E-01	6.19E-01	3.39E-01	8.57E-02	0.00E+00	8.21E-01
30	9.99E-01	1.00E+00	9.63E-01	7.80E-01	2.86E-01	2.50E-01	9.67E-01
40	1.00E+00	1.00E+00	9.98E-01	9.82E-01	8.86E-01	5.00E-01	9.97E-01
50	1.00E+00	1.00E+00	1.00E+00	9.98E-01	9.43E-01	7.50E-01	9.99E-01

P[Nfin<0.2K] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	1.41E-01	1.82E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.72E-02
10	8.88E-01	3.07E-01	7.70E-03	0.00E+00	0.00E+00	0.00E+00	3.65E-01
20	9.97E-01	9.16E-01	5.27E-01	1.49E-01	0.00E+00	0.00E+00	7.82E-01
30	1.00E+00	1.00E+00	9.60E-01	7.48E-01	2.57E-01	2.50E-01	9.64E-01
40	1.00E+00	1.00E+00	9.99E-01	9.82E-01	8.86E-01	5.00E-01	9.97E-01
50	1.00E+00	1.00E+00	1.00E+00	9.98E-01	9.43E-01	7.50E-01	9.99E-01

P[Nfin>MSYL] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	7.77E-04	0.00E+00	0.00E+00	1.84E-02	2.86E-01	7.50E-01	4.40E-03
10	0.00E+00	0.00E+00	0.00E+00	4.59E-03	1.43E-01	5.00E-01	1.80E-03
20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.71E-02	2.50E-01	6.00E-04
30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E-01	2.00E-04
40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E-01	2.00E-04
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

P[Nfin>MSYL] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	

0	7.77E-04	2.87E-02	4.44E-01	9.91E-01	1.00E+00	1.00E+00	1.99E-01
10	0.00E+00	0.00E+00	7.22E-02	5.80E-01	9.43E-01	1.00E+00	7.30E-02
20	0.00E+00	0.00E+00	4.81E-03	1.49E-01	7.71E-01	1.00E+00	2.02E-02
30	0.00E+00	0.00E+00	0.00E+00	6.88E-03	1.43E-01	5.00E-01	2.00E-03
40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.86E-02	2.50E-01	4.00E-04
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E-01	2.00E-04

P[Nfin>MSYL] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	4.66E-03	3.71E-01	9.87E-01	1.00E+00	1.00E+00	1.00E+00	4.64E-01
10	0.00E+00	3.82E-02	5.61E-01	9.95E-01	1.00E+00	1.00E+00	2.28E-01
20	0.00E+00	0.00E+00	7.22E-02	4.95E-01	9.14E-01	1.00E+00	6.54E-02
30	0.00E+00	0.00E+00	9.63E-04	6.42E-02	4.57E-01	7.50E-01	9.60E-03
40	0.00E+00	0.00E+00	0.00E+00	4.59E-03	1.14E-01	5.00E-01	1.60E-03
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E-01	2.00E-04

P[Nfin>Ncur] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	6.68E-02	7.79E-01	9.95E-01	1.00E+00	1.00E+00	1.00E+00	6.62E-01
20	0.00E+00	6.96E-02	4.73E-01	8.44E-01	9.14E-01	1.00E+00	2.10E-01
30	0.00E+00	0.00E+00	3.27E-02	2.18E-01	7.43E-01	7.50E-01	3.16E-02
40	0.00E+00	0.00E+00	9.63E-04	1.61E-02	1.14E-01	5.00E-01	2.80E-03
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.86E-02	2.50E-01	4.00E-04

P[Nfin>Ncur] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	1.67E-01	8.87E-01	9.99E-01	1.00E+00	1.00E+00	1.00E+00	7.36E-01
20	0.00E+00	8.87E-02	5.45E-01	8.60E-01	1.00E+00	1.00E+00	2.35E-01
30	0.00E+00	0.00E+00	3.66E-02	2.59E-01	7.43E-01	7.50E-01	3.60E-02
40	0.00E+00	0.00E+00	9.63E-04	1.84E-02	1.14E-01	5.00E-01	3.00E-03
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.86E-02	2.50E-01	4.00E-04

P[Nfin>Ncur] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	2.01E-01	9.13E-01	9.99E-01	1.00E+00	1.00E+00	1.00E+00	7.56E-01
20	0.00E+00	9.50E-02	5.70E-01	8.65E-01	1.00E+00	1.00E+00	2.43E-01

30	0.00E+00	0.00E+00	4.14E-02	2.59E-01	7.43E-01	7.50E-01	3.70E-02
40	0.00E+00	0.00E+00	9.63E-04	1.84E-02	1.14E-01	5.00E-01	3.00E-03
50	0.00E+00	0.00E+00	0.00E+00	2.29E-03	2.86E-02	2.50E-01	6.00E-04

P[N98>N93] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

P[N98>N93] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

P[N98>N93] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

E[T(MSYL)|recov] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	3.10E+01	2.92E+01	2.14E+01	1.55E+01	1.13E+01	8.50E+00	2.67E+01
10	3.10E+01	3.09E+01	2.75E+01	1.99E+01	1.36E+01	1.00E+01	2.85E+01
20	0.00E+00	3.10E+01	3.05E+01	2.66E+01	1.86E+01	1.30E+01	2.90E+01
30	0.00E+00	0.00E+00	3.09E+01	2.96E+01	2.62E+01	1.67E+01	2.92E+01

40	0.00E+00	0.00E+00	3.10E+01	2.99E+01	2.30E+01	1.65E+01	2.63E+01
50	0.00E+00	0.00E+00	0.00E+00	3.10E+01	3.10E+01	1.60E+01	2.60E+01

E[T(MSYL)|recov] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	3.10E+01	2.92E+01	2.14E+01	1.55E+01	1.13E+01	8.50E+00	2.67E+01
10	3.10E+01	3.09E+01	2.75E+01	1.99E+01	1.36E+01	1.00E+01	2.85E+01
20	0.00E+00	3.10E+01	3.05E+01	2.66E+01	1.86E+01	1.30E+01	2.90E+01
30	0.00E+00	0.00E+00	3.09E+01	2.96E+01	2.62E+01	1.67E+01	2.92E+01
40	0.00E+00	0.00E+00	3.10E+01	2.99E+01	2.30E+01	1.65E+01	2.63E+01
50	0.00E+00	0.00E+00	0.00E+00	3.10E+01	3.10E+01	1.60E+01	2.60E+01

E[T(MSYL)|recov] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.2574	0.4398	0.2078	0.0872	0.007	0.0008	
0	3.10E+01	2.92E+01	2.14E+01	1.55E+01	1.13E+01	8.50E+00	2.67E+01
10	3.10E+01	3.09E+01	2.75E+01	1.99E+01	1.36E+01	1.00E+01	2.85E+01
20	0.00E+00	3.10E+01	3.05E+01	2.66E+01	1.86E+01	1.30E+01	2.90E+01
30	0.00E+00	0.00E+00	3.09E+01	2.96E+01	2.62E+01	1.67E+01	2.92E+01
40	0.00E+00	0.00E+00	3.10E+01	2.99E+01	2.30E+01	1.65E+01	2.63E+01
50	0.00E+00	0.00E+00	0.00E+00	3.10E+01	3.10E+01	1.60E+01	2.60E+01

Large Coastals **Alt Catch** Cond on r

E[cat/yr] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	2.51E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.68E+00
10	6.45E+01	3.95E+00	3.95E+00	3.95E+00	3.95E+00	0.00E+00	2.73E+01
20	1.04E+02	7.89E+00	7.89E+00	7.89E+00	7.89E+00	0.00E+00	4.50E+01
30	1.43E+02	1.18E+01	1.18E+01	1.18E+01	1.18E+01	0.00E+00	6.26E+01
40	1.79E+02	1.41E+01	1.45E+01	1.49E+01	1.58E+01	0.00E+00	7.78E+01
50	2.00E+02	1.08E+01	1.39E+01	1.60E+01	1.97E+01	0.00E+00	8.42E+01

E[cat/yr] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	1.31E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.07E+00
10	5.45E+01	2.07E+00	2.07E+00	2.07E+00	2.07E+00	0.00E+00	2.23E+01
20	9.52E+01	4.11E+00	4.12E+00	4.13E+00	4.13E+00	0.00E+00	3.93E+01
30	1.22E+02	4.29E+00	5.64E+00	5.85E+00	6.20E+00	0.00E+00	5.01E+01
40	1.22E+02	1.42E+00	4.21E+00	6.71E+00	8.27E+00	0.00E+00	4.84E+01
50	1.15E+02	3.13E-01	1.10E+00	4.49E+00	6.89E+00	0.00E+00	4.48E+01

E[cat/yr] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	8.89E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.43E+00
10	5.09E+01	1.40E+00	1.40E+00	1.40E+00	1.40E+00	0.00E+00	2.05E+01
20	8.75E+01	2.61E+00	2.76E+00	2.80E+00	2.80E+00	0.00E+00	3.54E+01
30	9.13E+01	1.31E+00	3.31E+00	3.96E+00	4.20E+00	0.00E+00	3.63E+01
40	8.35E+01	1.79E-01	1.30E+00	3.91E+00	5.60E+00	0.00E+00	3.25E+01
50	7.81E+01	8.96E-03	1.81E-01	1.72E+00	4.67E+00	0.00E+00	3.02E+01

E[N 2008 in k] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	2.62E+03	2.89E+03	3.32E+03	3.88E+03	4.49E+03	0.00E+00	2.86E+03
10	2.20E+03	2.46E+03	2.92E+03	3.52E+03	4.19E+03	0.00E+00	2.44E+03
20	1.75E+03	1.97E+03	2.39E+03	3.00E+03	3.72E+03	0.00E+00	1.96E+03
30	1.30E+03	1.48E+03	1.85E+03	2.44E+03	3.20E+03	0.00E+00	1.47E+03
40	9.31E+02	1.02E+03	1.34E+03	1.89E+03	2.65E+03	0.00E+00	1.04E+03
50	6.94E+02	7.35E+02	9.34E+02	1.32E+03	2.04E+03	0.00E+00	7.55E+02

E[N 2018 in k] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	3.25E+03	4.23E+03	5.52E+03	6.36E+03	6.71E+03	0.00E+00	4.05E+03
10	2.28E+03	3.20E+03	4.58E+03	5.69E+03	6.28E+03	0.00E+00	3.07E+03
20	1.26E+03	2.02E+03	3.36E+03	4.73E+03	5.67E+03	0.00E+00	1.94E+03
30	6.61E+02	1.05E+03	2.08E+03	3.50E+03	4.88E+03	0.00E+00	1.07E+03
40	9.27E+02	9.68E+02	1.16E+03	2.22E+03	3.72E+03	0.00E+00	9.99E+02
50	9.94E+02	1.03E+03	1.17E+03	1.30E+03	2.53E+03	0.00E+00	1.04E+03

E[N 2028 in k] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	3.97E+03	5.74E+03	7.45E+03	7.71E+03	7.41E+03	0.00E+00	5.31E+03
10	2.38E+03	4.12E+03	6.29E+03	7.12E+03	7.07E+03	0.00E+00	3.78E+03
20	7.64E+02	2.08E+03	4.56E+03	6.20E+03	6.64E+03	0.00E+00	1.96E+03
30	6.12E+02	1.09E+03	2.47E+03	4.65E+03	6.02E+03	0.00E+00	1.14E+03
40	1.62E+03	1.72E+03	1.55E+03	2.82E+03	4.73E+03	0.00E+00	1.68E+03
50	3.44E+03	3.30E+03	3.39E+03	2.83E+03	3.95E+03	0.00E+00	3.37E+03

E[N 2008 / K] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	2.08E-01	2.55E-01	3.42E-01	4.62E-01	5.89E-01	0.00E+00	2.52E-01
10	1.75E-01	2.18E-01	3.00E-01	4.18E-01	5.50E-01	0.00E+00	2.15E-01
20	1.39E-01	1.75E-01	2.46E-01	3.56E-01	4.87E-01	0.00E+00	1.73E-01
30	1.03E-01	1.31E-01	1.90E-01	2.89E-01	4.19E-01	0.00E+00	1.30E-01
40	7.40E-02	9.02E-02	1.37E-01	2.23E-01	3.45E-01	0.00E+00	9.22E-02
50	5.50E-02	6.49E-02	9.57E-02	1.55E-01	2.65E-01	0.00E+00	6.67E-02

E[N 2018 / K] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	2.58E-01	3.75E-01	5.67E-01	7.57E-01	8.82E-01	0.00E+00	3.61E-01
10	1.81E-01	2.84E-01	4.71E-01	6.77E-01	8.26E-01	0.00E+00	2.75E-01
20	9.99E-02	1.79E-01	3.46E-01	5.61E-01	7.46E-01	0.00E+00	1.76E-01
30	5.42E-02	9.33E-02	2.14E-01	4.14E-01	6.40E-01	0.00E+00	9.92E-02
40	7.39E-02	8.51E-02	1.18E-01	2.61E-01	4.86E-01	0.00E+00	8.82E-02
50	7.94E-02	9.09E-02	1.21E-01	1.54E-01	3.29E-01	0.00E+00	9.18E-02

E[N 2028 / K] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	3.15E-01	5.08E-01	7.64E-01	9.19E-01	9.76E-01	0.00E+00	4.73E-01
10	1.90E-01	3.65E-01	6.46E-01	8.48E-01	9.31E-01	0.00E+00	3.41E-01
20	6.07E-02	1.85E-01	4.69E-01	7.38E-01	8.74E-01	0.00E+00	1.83E-01
30	5.27E-02	9.84E-02	2.54E-01	5.51E-01	7.91E-01	0.00E+00	1.08E-01
40	1.30E-01	1.51E-01	1.60E-01	3.34E-01	6.19E-01	0.00E+00	1.48E-01
50	2.73E-01	2.92E-01	3.49E-01	3.36E-01	5.19E-01	0.00E+00	2.93E-01

P[Extinct] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
30	7.25E-03	4.69E-03	6.08E-03	0.00E+00	0.00E+00	0.00E+00	5.80E-03
40	1.47E-01	1.06E-01	7.90E-02	5.66E-02	0.00E+00	0.00E+00	1.17E-01
50	4.89E-01	4.55E-01	2.96E-01	1.89E-01	0.00E+00	0.00E+00	4.43E-01

P[Extinct] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)

prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	4.97E-02	6.40E-03	3.04E-03	0.00E+00	0.00E+00	0.00E+00	2.26E-02
30	5.29E-01	3.09E-01	9.12E-02	5.66E-02	0.00E+00	0.00E+00	3.62E-01
40	9.38E-01	8.28E-01	4.91E-01	1.89E-01	0.00E+00	0.00E+00	8.17E-01
50	9.96E-01	9.70E-01	8.94E-01	5.66E-01	3.33E-01	0.00E+00	9.64E-01

P[Extinct] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	3.21E-01	7.00E-02	1.37E-02	0.00E+00	0.00E+00	0.00E+00	1.59E-01
30	9.32E-01	6.89E-01	2.11E-01	5.66E-02	0.00E+00	0.00E+00	7.11E-01
40	9.96E-01	9.68E-01	7.68E-01	3.02E-01	0.00E+00	0.00E+00	9.43E-01
50	1.00E+00	9.99E-01	9.74E-01	7.55E-01	3.33E-01	0.00E+00	9.91E-01

P[Nfin<0.2K] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	4.62E-01	1.66E-01	2.43E-02	0.00E+00	0.00E+00	0.00E+00	2.59E-01
10	7.30E-01	4.19E-01	5.32E-02	0.00E+00	0.00E+00	0.00E+00	4.85E-01
20	9.01E-01	6.93E-01	2.64E-01	5.66E-02	0.00E+00	0.00E+00	7.08E-01
30	9.64E-01	8.87E-01	5.53E-01	1.89E-01	0.00E+00	0.00E+00	8.63E-01
40	9.90E-01	9.64E-01	8.42E-01	3.21E-01	6.67E-02	0.00E+00	9.48E-01
50	9.96E-01	9.86E-01	9.35E-01	7.36E-01	3.33E-01	0.00E+00	9.79E-01

P[Nfin<0.2K] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	1.80E-01	6.83E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.26E-02
10	6.67E-01	1.54E-01	6.08E-03	0.00E+00	0.00E+00	0.00E+00	3.31E-01
20	9.49E-01	6.26E-01	8.51E-02	0.00E+00	0.00E+00	0.00E+00	6.71E-01
30	9.71E-01	9.07E-01	4.59E-01	9.43E-02	0.00E+00	0.00E+00	8.62E-01
40	9.38E-01	9.07E-01	8.34E-01	3.40E-01	0.00E+00	0.00E+00	9.00E-01
50	9.09E-01	8.97E-01	8.54E-01	6.79E-01	2.67E-01	0.00E+00	8.92E-01

P[Nfin<0.2K] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	7.77E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.00E-02
10	5.72E-01	5.63E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E-01

20	9.68E-01	5.82E-01	5.02E-02	0.00E+00	0.00E+00	0.00E+00	6.53E-01
30	9.11E-01	8.30E-01	4.20E-01	5.66E-02	0.00E+00	0.00E+00	7.97E-01
40	7.57E-01	7.06E-01	6.88E-01	3.02E-01	0.00E+00	0.00E+00	7.17E-01
50	3.21E-01	3.30E-01	2.28E-01	1.51E-01	6.67E-02	0.00E+00	3.10E-01

P[Nfin>MSYL] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	0.00E+00	0.00E+00	6.08E-03	2.83E-01	9.33E-01	0.00E+00	6.60E-03
10	0.00E+00	0.00E+00	4.56E-03	1.89E-01	6.67E-01	0.00E+00	4.60E-03
20	0.00E+00	0.00E+00	0.00E+00	3.77E-02	4.00E-01	0.00E+00	1.60E-03
30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-01	0.00E+00	1.00E-03
40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.67E-02	0.00E+00	2.00E-04
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.67E-02	0.00E+00	2.00E-04

P[Nfin>MSYL] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	0.00E+00	6.74E-02	7.77E-01	1.00E+00	1.00E+00	0.00E+00	1.47E-01
10	0.00E+00	1.28E-02	4.29E-01	1.00E+00	1.00E+00	0.00E+00	7.60E-02
20	0.00E+00	0.00E+00	6.54E-02	7.55E-01	1.00E+00	0.00E+00	1.96E-02
30	1.55E-03	0.00E+00	7.60E-03	3.02E-01	9.33E-01	0.00E+00	7.60E-03
40	1.55E-03	8.53E-04	6.08E-03	7.55E-02	6.67E-01	0.00E+00	4.60E-03
50	4.15E-03	8.96E-03	5.62E-02	0.00E+00	3.33E-01	0.00E+00	1.42E-02

P[Nfin>MSYL] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	1.24E-02	5.12E-01	9.97E-01	1.00E+00	1.00E+00	0.00E+00	3.90E-01
10	0.00E+00	1.25E-01	9.18E-01	1.00E+00	1.00E+00	0.00E+00	1.93E-01
20	0.00E+00	1.28E-02	4.62E-01	1.00E+00	1.00E+00	0.00E+00	8.04E-02
30	9.33E-03	1.20E-02	6.84E-02	7.36E-01	1.00E+00	0.00E+00	2.90E-02
40	1.40E-02	2.30E-02	4.26E-02	2.64E-01	6.67E-01	0.00E+00	2.66E-02
50	2.07E-02	3.03E-02	2.26E-01	1.70E-01	4.67E-01	0.00E+00	5.52E-02

P[Nfin>Ncur] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.00E+00	1.00E+00
10	3.88E-01	9.89E-01	1.00E+00	1.00E+00	1.00E+00	0.00E+00	7.58E-01
20	0.00E+00	3.51E-01	9.51E-01	1.00E+00	1.00E+00	0.00E+00	3.03E-01

30	0.00E+00	3.37E-02	5.09E-01	9.43E-01	1.00E+00	0.00E+00	9.58E-02
40	3.42E-02	1.02E-02	7.90E-02	5.85E-01	1.00E+00	0.00E+00	3.76E-02
50	1.40E-02	1.96E-02	5.32E-02	1.51E-01	6.67E-01	0.00E+00	2.52E-02

P[Nfin>Ncur] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.00E+00	1.00E+00
10	5.43E-01	9.97E-01	1.00E+00	1.00E+00	1.00E+00	0.00E+00	8.22E-01
20	5.18E-04	4.39E-01	9.70E-01	1.00E+00	1.00E+00	0.00E+00	3.47E-01
30	3.63E-02	8.28E-02	6.03E-01	9.43E-01	1.00E+00	0.00E+00	1.45E-01
40	8.96E-02	1.34E-01	1.67E-01	6.42E-01	1.00E+00	0.00E+00	1.29E-01
50	9.95E-02	1.31E-01	1.49E-01	2.26E-01	7.33E-01	0.00E+00	1.24E-01

P[Nfin>Ncur] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.00E+00	1.00E+00
10	5.86E-01	9.97E-01	1.00E+00	1.00E+00	1.00E+00	0.00E+00	8.39E-01
20	1.55E-03	4.67E-01	9.71E-01	1.00E+00	1.00E+00	0.00E+00	3.61E-01
30	9.12E-02	1.78E-01	6.22E-01	9.43E-01	1.00E+00	0.00E+00	2.13E-01
40	2.85E-01	3.61E-01	3.27E-01	6.98E-01	1.00E+00	0.00E+00	3.33E-01
50	7.28E-01	7.58E-01	7.74E-01	7.36E-01	9.33E-01	0.00E+00	7.49E-01

P[N98>N93] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

P[N98>N93] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

P[N98>N93] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

E[T(MSYL)|recov] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	3.10E+01	2.78E+01	1.78E+01	1.17E+01	8.20E+00	0.00E+00	2.75E+01
10	3.10E+01	3.04E+01	2.22E+01	1.36E+01	9.07E+00	0.00E+00	2.90E+01
20	3.10E+01	3.09E+01	2.78E+01	1.79E+01	1.10E+01	0.00E+00	2.93E+01
30	3.04E+01	3.07E+01	3.04E+01	2.36E+01	1.41E+01	0.00E+00	3.00E+01
40	3.07E+01	3.07E+01	3.03E+01	2.81E+01	2.05E+01	0.00E+00	3.05E+01
50	3.08E+01	3.08E+01	2.93E+01	2.96E+01	2.51E+01	0.00E+00	3.06E+01

E[T(MSYL)|recov] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	3.10E+01	2.78E+01	1.78E+01	1.17E+01	8.20E+00	0.00E+00	2.75E+01
10	3.10E+01	3.04E+01	2.22E+01	1.36E+01	9.07E+00	0.00E+00	2.90E+01
20	3.10E+01	3.09E+01	2.78E+01	1.79E+01	1.10E+01	0.00E+00	2.93E+01
30	3.04E+01	3.07E+01	3.04E+01	2.36E+01	1.41E+01	0.00E+00	3.00E+01
40	3.07E+01	3.07E+01	3.03E+01	2.81E+01	2.05E+01	0.00E+00	3.05E+01
50	3.08E+01	3.08E+01	2.93E+01	2.96E+01	2.51E+01	0.00E+00	3.06E+01

E[T(MSYL)|recov] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.386	0.4688	0.1316	0.0106	0.003	0	
0	3.10E+01	2.78E+01	1.78E+01	1.17E+01	8.20E+00	0.00E+00	2.75E+01
10	3.10E+01	3.04E+01	2.22E+01	1.36E+01	9.07E+00	0.00E+00	2.90E+01
20	3.10E+01	3.09E+01	2.78E+01	1.79E+01	1.10E+01	0.00E+00	2.93E+01
30	3.04E+01	3.07E+01	3.04E+01	2.36E+01	1.41E+01	0.00E+00	3.00E+01
40	3.07E+01	3.07E+01	3.03E+01	2.81E+01	2.05E+01	0.00E+00	3.05E+01
50	3.08E+01	3.08E+01	2.93E+01	2.96E+01	2.51E+01	0.00E+00	3.06E+01

Sandbar **Baseline** Cond on r

E[cat/yr] 10 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
	0	3.41E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.77E+01
	10	3.51E+02	9.78E-01	9.78E-01	9.78E-01	9.78E-01	9.78E-01	4.99E+01
	20	3.61E+02	1.96E+00	1.96E+00	1.96E+00	1.96E+00	1.96E+00	5.21E+01
	30	3.71E+02	2.92E+00	2.92E+00	2.93E+00	2.94E+00	2.94E+00	5.43E+01
	40	3.80E+02	3.81E+00	3.86E+00	3.87E+00	3.91E+00	3.90E+00	5.64E+01
	50	3.89E+02	4.60E+00	4.65E+00	4.66E+00	4.88E+00	4.88E+00	5.84E+01

E[cat/yr] 20 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
	0	1.79E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E+01
	10	1.89E+02	5.12E-01	5.12E-01	5.12E-01	5.12E-01	5.12E-01	2.69E+01
	20	1.99E+02	1.02E+00	1.02E+00	1.03E+00	1.03E+00	1.03E+00	2.87E+01
	30	2.09E+02	1.47E+00	1.51E+00	1.53E+00	1.54E+00	1.54E+00	3.05E+01
	40	2.17E+02	1.75E+00	1.89E+00	1.95E+00	2.04E+00	2.05E+00	3.19E+01
	50	2.24E+02	1.81E+00	2.03E+00	2.23E+00	2.41E+00	2.54E+00	3.30E+01

E[cat/yr] 30 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
	0	1.21E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E+01
	10	1.32E+02	3.47E-01	3.47E-01	3.47E-01	3.47E-01	3.47E-01	1.87E+01
	20	1.42E+02	6.81E-01	6.91E-01	6.94E-01	6.94E-01	6.94E-01	2.04E+01
	30	1.50E+02	9.23E-01	1.00E+00	1.03E+00	1.04E+00	1.04E+00	2.18E+01
	40	1.56E+02	1.00E+00	1.21E+00	1.28E+00	1.38E+00	1.39E+00	2.29E+01
	50	1.60E+02	7.96E-01	1.19E+00	1.48E+00	1.63E+00	1.72E+00	2.33E+01

E[N 2008 in k] 10 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
	0	1.39E+03	1.32E+03	1.46E+03	1.56E+03	1.57E+03	1.77E+03	1.45E+03
	10	1.30E+03	1.23E+03	1.39E+03	1.49E+03	1.51E+03	1.74E+03	1.37E+03
	20	1.19E+03	1.12E+03	1.27E+03	1.38E+03	1.41E+03	1.67E+03	1.26E+03
	30	1.08E+03	1.01E+03	1.15E+03	1.27E+03	1.30E+03	1.59E+03	1.15E+03
	40	9.71E+02	8.89E+02	1.03E+03	1.14E+03	1.18E+03	1.50E+03	1.04E+03
	50	8.66E+02	7.75E+02	9.11E+02	1.02E+03	1.06E+03	1.41E+03	9.22E+02

E[N 2018 in k] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	1.65E+03	1.80E+03	2.12E+03	2.26E+03	2.18E+03	2.17E+03	1.96E+03
10	1.44E+03	1.58E+03	1.95E+03	2.14E+03	2.10E+03	2.12E+03	1.79E+03
20	1.20E+03	1.33E+03	1.72E+03	1.97E+03	1.98E+03	2.06E+03	1.59E+03
30	9.74E+02	1.08E+03	1.48E+03	1.77E+03	1.84E+03	1.99E+03	1.37E+03
40	7.66E+02	8.25E+02	1.21E+03	1.53E+03	1.66E+03	1.91E+03	1.14E+03
50	5.83E+02	6.01E+02	9.52E+02	1.29E+03	1.44E+03	1.81E+03	9.21E+02

E[N 2028 in k] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	1.93E+03	2.26E+03	2.59E+03	2.59E+03	2.36E+03	2.22E+03	2.33E+03
10	1.58E+03	1.95E+03	2.39E+03	2.47E+03	2.29E+03	2.17E+03	2.10E+03
20	1.22E+03	1.57E+03	2.12E+03	2.32E+03	2.20E+03	2.12E+03	1.82E+03
30	8.82E+02	1.16E+03	1.79E+03	2.12E+03	2.09E+03	2.07E+03	1.52E+03
40	6.05E+02	7.84E+02	1.40E+03	1.84E+03	1.93E+03	2.01E+03	1.21E+03
50	4.11E+02	4.83E+02	1.03E+03	1.53E+03	1.70E+03	1.93E+03	9.29E+02

E[N 2008 / K] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	3.36E-01	3.72E-01	4.85E-01	5.77E-01	6.63E-01	8.16E-01	4.75E-01
10	3.12E-01	3.46E-01	4.58E-01	5.51E-01	6.38E-01	7.99E-01	4.50E-01
20	2.84E-01	3.12E-01	4.18E-01	5.08E-01	5.93E-01	7.63E-01	4.14E-01
30	2.57E-01	2.79E-01	3.78E-01	4.62E-01	5.45E-01	7.24E-01	3.77E-01
40	2.30E-01	2.45E-01	3.36E-01	4.15E-01	4.93E-01	6.82E-01	3.39E-01
50	2.03E-01	2.12E-01	2.94E-01	3.67E-01	4.39E-01	6.36E-01	3.00E-01

E[N 2018 / K] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	4.00E-01	5.05E-01	7.00E-01	8.33E-01	9.12E-01	9.77E-01	6.42E-01
10	3.45E-01	4.43E-01	6.41E-01	7.85E-01	8.75E-01	9.53E-01	5.88E-01
20	2.85E-01	3.70E-01	5.65E-01	7.19E-01	8.23E-01	9.23E-01	5.23E-01
30	2.28E-01	2.95E-01	4.79E-01	6.40E-01	7.60E-01	8.89E-01	4.52E-01
40	1.77E-01	2.22E-01	3.88E-01	5.48E-01	6.80E-01	8.49E-01	3.78E-01
50	1.32E-01	1.59E-01	2.99E-01	4.54E-01	5.81E-01	7.97E-01	3.06E-01

E[N 2028 / K] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)

prob. per bin		0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
	0	4.66E-01	6.34E-01	8.53E-01	9.49E-01	9.83E-01	9.97E-01	7.52E-01
	10	3.79E-01	5.43E-01	7.86E-01	9.05E-01	9.51E-01	9.75E-01	6.83E-01
	20	2.87E-01	4.32E-01	6.94E-01	8.47E-01	9.12E-01	9.51E-01	5.98E-01
	30	2.03E-01	3.14E-01	5.78E-01	7.64E-01	8.64E-01	9.22E-01	5.02E-01
	40	1.37E-01	2.07E-01	4.43E-01	6.52E-01	7.88E-01	8.92E-01	4.03E-01
	50	9.23E-02	1.23E-01	3.17E-01	5.33E-01	6.83E-01	8.49E-01	3.13E-01

P[Extinct] 10 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	20	0.00E+00	5.49E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-04
	30	1.43E-02	5.49E-03	4.60E-03	1.69E-03	0.00E+00	0.00E+00	5.20E-03
	40	4.15E-02	2.63E-02	1.47E-02	1.18E-02	0.00E+00	2.33E-03	2.02E-02
	50	8.58E-02	5.87E-02	4.96E-02	4.73E-02	2.71E-03	2.33E-03	5.02E-02

P[Extinct] 20 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	20	1.86E-02	6.58E-03	1.84E-03	0.00E+00	0.00E+00	0.00E+00	5.40E-03
	30	1.00E-01	4.11E-02	1.65E-02	6.76E-03	0.00E+00	0.00E+00	3.34E-02
	40	2.00E-01	1.47E-01	7.72E-02	4.90E-02	2.71E-03	2.33E-03	1.05E-01
	50	3.68E-01	2.94E-01	2.07E-01	1.30E-01	5.96E-02	9.32E-03	2.24E-01

P[Extinct] 30 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	10	1.43E-03	5.49E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-04
	20	5.87E-02	1.92E-02	4.60E-03	0.00E+00	0.00E+00	0.00E+00	1.62E-02
	30	2.03E-01	1.14E-01	3.86E-02	1.18E-02	0.00E+00	2.33E-03	7.98E-02
	40	4.32E-01	2.79E-01	1.31E-01	7.77E-02	8.13E-03	2.33E-03	2.01E-01
	50	5.92E-01	5.41E-01	3.16E-01	1.49E-01	6.23E-02	9.32E-03	3.72E-01

P[Nfin<0.2K] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	

0	1.89E-01	6.09E-02	1.20E-02	0.00E+00	0.00E+00	0.00E+00	5.12E-02
10	2.62E-01	1.21E-01	2.85E-02	1.69E-03	0.00E+00	0.00E+00	8.72E-02
20	3.12E-01	2.05E-01	6.89E-02	2.20E-02	0.00E+00	0.00E+00	1.36E-01
30	3.81E-01	2.90E-01	1.20E-01	5.24E-02	2.71E-03	2.33E-03	1.91E-01
40	5.04E-01	3.66E-01	2.18E-01	1.25E-01	4.34E-02	2.33E-03	2.69E-01
50	5.79E-01	4.84E-01	3.47E-01	1.91E-01	9.21E-02	1.87E-02	3.64E-01

P[Nfin<0.2K] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	8.58E-02	8.78E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-02
10	2.12E-01	4.00E-02	4.60E-03	0.00E+00	0.00E+00	0.00E+00	4.52E-02
20	3.26E-01	1.53E-01	2.21E-02	1.69E-03	0.00E+00	0.00E+00	1.06E-01
30	4.92E-01	2.91E-01	8.27E-02	3.21E-02	0.00E+00	2.33E-03	1.97E-01
40	6.25E-01	4.89E-01	2.01E-01	9.80E-02	1.36E-02	2.33E-03	3.22E-01
50	7.18E-01	6.51E-01	3.80E-01	1.89E-01	6.78E-02	9.32E-03	4.48E-01

P[Nfin<0.2K] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	2.86E-02	1.10E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.40E-03
10	1.70E-01	2.03E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.12E-02
20	3.42E-01	1.00E-01	1.10E-02	1.69E-03	0.00E+00	0.00E+00	8.70E-02
30	5.68E-01	2.91E-01	6.62E-02	1.69E-02	0.00E+00	2.33E-03	2.02E-01
40	7.02E-01	5.40E-01	2.18E-01	8.78E-02	1.08E-02	2.33E-03	3.54E-01
50	7.97E-01	7.15E-01	4.11E-01	1.84E-01	7.05E-02	9.32E-03	4.89E-01

P[Nfin>MSYL] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	1.77E-01	1.76E-01	4.16E-01	6.94E-01	9.11E-01	9.93E-01	4.14E-01
10	1.45E-01	1.06E-01	3.60E-01	6.45E-01	8.67E-01	9.93E-01	3.63E-01
20	1.23E-01	7.79E-02	2.90E-01	5.59E-01	7.32E-01	9.70E-01	3.12E-01
30	3.00E-02	6.42E-02	2.40E-01	4.56E-01	6.10E-01	9.37E-01	2.59E-01
40	2.00E-02	3.84E-02	2.03E-01	3.60E-01	5.18E-01	8.60E-01	2.16E-01
50	2.00E-02	1.21E-02	1.65E-01	2.31E-01	3.90E-01	7.97E-01	1.68E-01

P[Nfin>MSYL] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	2.53E-01	5.31E-01	9.30E-01	9.98E-01	1.00E+00	1.00E+00	7.09E-01
10	1.92E-01	3.45E-01	8.45E-01	9.88E-01	1.00E+00	1.00E+00	6.13E-01
20	1.62E-01	2.22E-01	6.70E-01	9.32E-01	1.00E+00	1.00E+00	5.19E-01

30	1.14E-01	1.06E-01	4.96E-01	8.26E-01	9.57E-01	9.98E-01	4.17E-01
40	2.00E-02	6.42E-02	3.31E-01	6.74E-01	9.00E-01	9.91E-01	3.29E-01
50	0.00E+00	2.08E-02	2.37E-01	5.46E-01	7.51E-01	9.63E-01	2.62E-01

P[Nfin>MSYL] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	3.99E-01	8.10E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	8.47E-01
10	2.49E-01	6.03E-01	9.77E-01	1.00E+00	1.00E+00	1.00E+00	7.45E-01
20	1.72E-01	3.90E-01	9.03E-01	9.95E-01	1.00E+00	1.00E+00	6.40E-01
30	1.23E-01	1.87E-01	7.11E-01	9.49E-01	1.00E+00	9.98E-01	5.12E-01
40	0.00E+00	9.98E-02	5.09E-01	8.45E-01	9.46E-01	9.98E-01	4.03E-01
50	0.00E+00	3.13E-02	3.24E-01	6.76E-01	8.32E-01	9.88E-01	3.08E-01

P[Nfin>Ncur] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	9.99E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	8.51E-01	9.92E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.76E-01
20	4.39E-01	8.95E-01	9.91E-01	9.98E-01	1.00E+00	1.00E+00	8.81E-01
30	1.63E-01	5.60E-01	9.27E-01	9.83E-01	1.00E+00	9.98E-01	7.04E-01
40	1.00E-02	2.83E-01	7.57E-01	9.05E-01	9.89E-01	9.98E-01	5.35E-01
50	0.00E+00	1.12E-01	5.37E-01	8.06E-01	9.30E-01	9.91E-01	4.07E-01

P[Nfin>Ncur] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	9.00E-01	9.96E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.85E-01
20	4.78E-01	9.14E-01	9.93E-01	9.98E-01	1.00E+00	1.00E+00	8.94E-01
30	1.79E-01	6.02E-01	9.32E-01	9.87E-01	1.00E+00	9.98E-01	7.23E-01
40	1.72E-02	3.07E-01	7.65E-01	9.07E-01	9.89E-01	9.98E-01	5.47E-01
50	0.00E+00	1.17E-01	5.46E-01	8.09E-01	9.30E-01	9.91E-01	4.11E-01

P[Nfin>Ncur] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	9.13E-01	9.98E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.87E-01
20	4.95E-01	9.20E-01	9.94E-01	9.98E-01	1.00E+00	1.00E+00	8.99E-01
30	1.83E-01	6.18E-01	9.39E-01	9.87E-01	1.00E+00	9.98E-01	7.31E-01
40	1.72E-02	3.09E-01	7.66E-01	9.07E-01	9.92E-01	9.98E-01	5.48E-01
50	0.00E+00	1.18E-01	5.48E-01	8.11E-01	9.30E-01	9.91E-01	4.12E-01

P[N98>N93] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
10	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
20	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
30	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
40	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
50	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02

P[N98>N93] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
10	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
20	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
30	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
40	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
50	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02

P[N98>N93] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
10	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
20	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
30	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
40	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02
50	0.00E+00	0.00E+00	1.01E-02	8.95E-02	1.60E-01	5.55E-01	7.22E-02

E[T(MSYL)|recov] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	2.42E+01	1.97E+01	1.14E+01	8.20E+00	6.50E+00	4.32E+00	1.49E+01
10	2.54E+01	2.29E+01	1.31E+01	8.86E+00	6.67E+00	4.19E+00	1.65E+01
20	2.30E+01	2.56E+01	1.59E+01	1.05E+01	7.67E+00	4.58E+00	1.76E+01
30	2.04E+01	2.66E+01	1.88E+01	1.27E+01	9.12E+00	5.00E+00	1.77E+01
40	1.23E+01	2.57E+01	2.01E+01	1.44E+01	1.13E+01	5.75E+00	1.66E+01
50	1.00E+00	2.66E+01	2.01E+01	1.66E+01	1.36E+01	6.74E+00	1.60E+01

E[T(MSYL)|recov] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	2.42E+01	1.97E+01	1.14E+01	8.20E+00	6.50E+00	4.32E+00	1.49E+01
10	2.54E+01	2.29E+01	1.31E+01	8.86E+00	6.67E+00	4.19E+00	1.65E+01
20	2.30E+01	2.56E+01	1.59E+01	1.05E+01	7.67E+00	4.58E+00	1.76E+01
30	2.04E+01	2.66E+01	1.88E+01	1.27E+01	9.12E+00	5.00E+00	1.77E+01
40	1.23E+01	2.57E+01	2.01E+01	1.44E+01	1.13E+01	5.75E+00	1.66E+01
50	1.00E+00	2.66E+01	2.01E+01	1.66E+01	1.36E+01	6.74E+00	1.60E+01

E[T(MSYL)|recov] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1398	0.3646	0.2176	0.1184	0.0738	0.0858	
0	2.42E+01	1.97E+01	1.14E+01	8.20E+00	6.50E+00	4.32E+00	1.49E+01
10	2.54E+01	2.29E+01	1.31E+01	8.86E+00	6.67E+00	4.19E+00	1.65E+01
20	2.30E+01	2.56E+01	1.59E+01	1.05E+01	7.67E+00	4.58E+00	1.76E+01
30	2.04E+01	2.66E+01	1.88E+01	1.27E+01	9.12E+00	5.00E+00	1.77E+01
40	1.23E+01	2.57E+01	2.01E+01	1.44E+01	1.13E+01	5.75E+00	1.66E+01
50	1.00E+00	2.66E+01	2.01E+01	1.66E+01	1.36E+01	6.74E+00	1.60E+01

Sandbar **Alt Catch** Cond on r

E[cat/yr] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	3.89E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.67E+01
10	3.99E+02	9.78E-01	9.78E-01	9.78E-01	9.78E-01	9.78E-01	2.82E+01
20	4.08E+02	1.96E+00	1.96E+00	1.96E+00	1.96E+00	1.96E+00	2.98E+01
30	4.18E+02	2.94E+00	2.94E+00	2.94E+00	2.94E+00	2.94E+00	3.14E+01
40	4.28E+02	3.85E+00	3.89E+00	3.89E+00	3.91E+00	3.91E+00	3.30E+01
50	4.38E+02	4.73E+00	4.74E+00	4.83E+00	4.89E+00	4.89E+00	3.45E+01

E[cat/yr] 20-year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	2.04E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.40E+01
10	2.14E+02	5.12E-01	5.12E-01	5.12E-01	5.12E-01	5.12E-01	1.51E+01
20	2.24E+02	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.03E+00	1.63E+01
30	2.34E+02	1.50E+00	1.53E+00	1.53E+00	1.54E+00	1.54E+00	1.75E+01
40	2.44E+02	1.90E+00	1.96E+00	2.03E+00	2.05E+00	2.05E+00	1.86E+01
50	2.52E+02	2.14E+00	2.25E+00	2.45E+00	2.55E+00	2.56E+00	1.95E+01

E[cat/yr] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)

prob. per bin		0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
	0	1.38E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.46E+00
	10	1.48E+02	3.47E-01	3.47E-01	3.47E-01	3.47E-01	3.47E-01	1.05E+01
	20	1.59E+02	6.92E-01	6.94E-01	6.94E-01	6.94E-01	6.94E-01	1.15E+01
	30	1.69E+02	9.83E-01	1.01E+00	1.04E+00	1.04E+00	1.04E+00	1.25E+01
	40	1.77E+02	1.21E+00	1.29E+00	1.37E+00	1.39E+00	1.39E+00	1.34E+01
	50	1.82E+02	1.14E+00	1.42E+00	1.59E+00	1.72E+00	1.73E+00	1.39E+01

E[N 2008 in k] 10 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
	0	1.58E+03	1.60E+03	1.56E+03	1.70E+03	1.99E+03	1.66E+03	1.67E+03
	10	1.48E+03	1.52E+03	1.49E+03	1.64E+03	1.95E+03	1.64E+03	1.62E+03
	20	1.38E+03	1.41E+03	1.37E+03	1.53E+03	1.86E+03	1.59E+03	1.53E+03
	30	1.27E+03	1.30E+03	1.25E+03	1.42E+03	1.77E+03	1.54E+03	1.45E+03
	40	1.16E+03	1.18E+03	1.13E+03	1.30E+03	1.67E+03	1.49E+03	1.36E+03
	50	1.04E+03	1.07E+03	1.01E+03	1.18E+03	1.57E+03	1.43E+03	1.26E+03

E[N 2018 in k] 20 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
	0	1.91E+03	2.15E+03	2.29E+03	2.45E+03	2.53E+03	1.82E+03	2.10E+03
	10	1.69E+03	1.95E+03	2.12E+03	2.33E+03	2.46E+03	1.78E+03	1.99E+03
	20	1.45E+03	1.72E+03	1.90E+03	2.17E+03	2.37E+03	1.74E+03	1.85E+03
	30	1.21E+03	1.47E+03	1.65E+03	1.99E+03	2.27E+03	1.70E+03	1.71E+03
	40	9.73E+02	1.22E+03	1.39E+03	1.78E+03	2.15E+03	1.65E+03	1.56E+03
	50	7.59E+02	9.77E+02	1.12E+03	1.53E+03	2.02E+03	1.60E+03	1.40E+03

E[N 2028 in k] 30 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
	0	2.26E+03	2.66E+03	2.81E+03	2.78E+03	2.66E+03	1.83E+03	2.35E+03
	10	1.92E+03	2.37E+03	2.61E+03	2.67E+03	2.59E+03	1.80E+03	2.21E+03
	20	1.54E+03	2.02E+03	2.35E+03	2.53E+03	2.52E+03	1.76E+03	2.05E+03
	30	1.15E+03	1.65E+03	2.03E+03	2.36E+03	2.44E+03	1.72E+03	1.86E+03
	40	8.09E+02	1.26E+03	1.65E+03	2.13E+03	2.34E+03	1.68E+03	1.66E+03
	50	5.39E+02	9.24E+02	1.24E+03	1.84E+03	2.22E+03	1.64E+03	1.46E+03

E[N 2008 / K] 10 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.0686	0.19	0.1343	0.1179	0.1057	0.3836	

0	3.25E-01	4.04E-01	4.74E-01	5.79E-01	7.41E-01	9.20E-01	6.62E-01
10	3.06E-01	3.83E-01	4.51E-01	5.58E-01	7.25E-01	9.05E-01	6.44E-01
20	2.82E-01	3.54E-01	4.15E-01	5.20E-01	6.91E-01	8.80E-01	6.14E-01
30	2.59E-01	3.25E-01	3.79E-01	4.80E-01	6.56E-01	8.54E-01	5.84E-01
40	2.36E-01	2.96E-01	3.42E-01	4.38E-01	6.19E-01	8.26E-01	5.52E-01
50	2.12E-01	2.66E-01	3.04E-01	3.95E-01	5.81E-01	7.96E-01	5.19E-01

E[N 2018 / K] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	3.94E-01	5.43E-01	6.93E-01	8.37E-01	9.43E-01	9.92E-01	8.02E-01
10	3.48E-01	4.92E-01	6.41E-01	7.96E-01	9.15E-01	9.73E-01	7.67E-01
20	2.97E-01	4.31E-01	5.74E-01	7.39E-01	8.81E-01	9.52E-01	7.25E-01
30	2.46E-01	3.67E-01	4.98E-01	6.75E-01	8.42E-01	9.29E-01	6.79E-01
40	1.95E-01	3.04E-01	4.17E-01	6.00E-01	7.97E-01	9.05E-01	6.29E-01
50	1.50E-01	2.42E-01	3.33E-01	5.14E-01	7.43E-01	8.77E-01	5.77E-01

E[N 2028 / K] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	4.66E-01	6.71E-01	8.49E-01	9.50E-01	9.90E-01	9.99E-01	8.73E-01
10	3.94E-01	5.97E-01	7.90E-01	9.13E-01	9.65E-01	9.81E-01	8.32E-01
20	3.14E-01	5.08E-01	7.10E-01	8.64E-01	9.36E-01	9.61E-01	7.83E-01
30	2.32E-01	4.11E-01	6.11E-01	8.02E-01	9.05E-01	9.41E-01	7.27E-01
40	1.59E-01	3.13E-01	4.94E-01	7.21E-01	8.68E-01	9.18E-01	6.66E-01
50	1.03E-01	2.27E-01	3.68E-01	6.14E-01	8.20E-01	8.94E-01	6.02E-01

P[Extinct] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	0.00E+00	1.50E-02	5.32E-03	6.06E-03	0.00E+00	0.00E+00	4.29E-03
50	1.04E-02	3.38E-02	3.19E-02	1.21E-02	0.00E+00	0.00E+00	1.29E-02

P[Extinct] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

30	1.04E-02	2.26E-02	5.32E-03	6.06E-03	0.00E+00	0.00E+00	6.43E-03
40	8.33E-02	7.52E-02	4.26E-02	1.21E-02	0.00E+00	0.00E+00	2.71E-02
50	1.98E-01	1.65E-01	1.22E-01	4.24E-02	6.76E-03	1.86E-03	6.79E-02

P[Extinct] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	1.04E-02	3.76E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-03
30	8.33E-02	5.64E-02	3.19E-02	6.06E-03	0.00E+00	0.00E+00	2.14E-02
40	2.19E-01	1.28E-01	7.45E-02	1.21E-02	0.00E+00	0.00E+00	5.07E-02
50	4.79E-01	3.46E-01	1.81E-01	8.49E-02	6.76E-03	1.86E-03	1.34E-01

P[Nfin<0.2K] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	1.25E-01	5.64E-02	1.60E-02	0.00E+00	0.00E+00	0.00E+00	2.14E-02
10	1.88E-01	7.90E-02	3.19E-02	6.06E-03	0.00E+00	0.00E+00	3.29E-02
20	2.60E-01	1.20E-01	5.32E-02	6.06E-03	0.00E+00	0.00E+00	4.86E-02
30	3.13E-01	2.14E-01	9.57E-02	2.42E-02	0.00E+00	0.00E+00	7.79E-02
40	4.17E-01	2.67E-01	2.29E-01	3.64E-02	0.00E+00	1.86E-03	1.15E-01
50	5.42E-01	3.76E-01	2.71E-01	1.03E-01	6.76E-03	1.86E-03	1.59E-01

P[Nfin<0.2K] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	5.21E-02	7.52E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.00E-03
10	1.15E-01	3.38E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-02
20	2.50E-01	7.90E-02	1.60E-02	6.06E-03	0.00E+00	0.00E+00	3.50E-02
30	3.85E-01	1.92E-01	5.85E-02	6.06E-03	0.00E+00	0.00E+00	7.14E-02
40	5.94E-01	3.46E-01	1.33E-01	3.03E-02	0.00E+00	0.00E+00	1.28E-01
50	6.77E-01	4.40E-01	2.98E-01	9.70E-02	6.76E-03	1.86E-03	1.83E-01

P[Nfin<0.2K] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	2.08E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-03
10	6.25E-02	1.13E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.43E-03
20	2.40E-01	6.77E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.93E-02
30	5.00E-01	1.81E-01	3.72E-02	6.06E-03	0.00E+00	0.00E+00	7.43E-02
40	6.56E-01	3.87E-01	1.22E-01	3.03E-02	0.00E+00	0.00E+00	1.39E-01
50	7.71E-01	5.08E-01	3.19E-01	9.70E-02	6.76E-03	1.86E-03	2.05E-01

P[Nfin>MSYL] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	8.33E-02	2.59E-01	4.84E-01	7.58E-01	9.93E-01	1.00E+00	6.98E-01
10	6.25E-02	2.29E-01	4.10E-01	6.91E-01	9.80E-01	9.98E-01	6.71E-01
20	5.21E-02	2.11E-01	3.03E-01	5.64E-01	9.60E-01	9.98E-01	6.35E-01
30	3.13E-02	1.65E-01	2.23E-01	4.36E-01	8.99E-01	9.91E-01	5.90E-01
40	0.00E+00	9.77E-02	9.57E-02	3.27E-01	8.31E-01	9.81E-01	5.34E-01
50	0.00E+00	4.51E-02	4.79E-02	2.42E-01	8.11E-01	9.61E-01	4.98E-01

P[Nfin>MSYL] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	1.67E-01	5.98E-01	9.36E-01	1.00E+00	1.00E+00	1.00E+00	8.58E-01
10	1.15E-01	5.19E-01	8.14E-01	9.94E-01	1.00E+00	1.00E+00	8.22E-01
20	5.21E-02	3.23E-01	7.07E-01	9.70E-01	1.00E+00	1.00E+00	7.64E-01
30	3.13E-02	2.41E-01	5.80E-01	9.03E-01	1.00E+00	1.00E+00	7.21E-01
40	1.04E-02	2.18E-01	4.26E-01	8.06E-01	9.93E-01	9.98E-01	6.82E-01
50	0.00E+00	1.39E-01	2.50E-01	5.94E-01	9.60E-01	9.98E-01	6.14E-01

P[Nfin>MSYL] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	4.27E-01	8.65E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.35E-01
10	2.60E-01	6.81E-01	9.89E-01	1.00E+00	1.00E+00	1.00E+00	8.87E-01
20	1.04E-01	5.41E-01	9.20E-01	9.94E-01	1.00E+00	1.00E+00	8.40E-01
30	3.13E-02	3.91E-01	7.93E-01	9.70E-01	1.00E+00	1.00E+00	7.86E-01
40	1.04E-02	2.33E-01	5.96E-01	9.21E-01	1.00E+00	1.00E+00	7.23E-01
50	0.00E+00	1.73E-01	3.99E-01	8.24E-01	9.87E-01	9.98E-01	6.71E-01

P[Nfin>Ncur] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	9.79E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.99E-01
20	6.77E-01	9.55E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.69E-01
30	2.50E-01	7.67E-01	9.57E-01	9.94E-01	1.00E+00	1.00E+00	8.98E-01
40	8.33E-02	5.00E-01	8.56E-01	9.70E-01	1.00E+00	1.00E+00	8.19E-01
50	0.00E+00	2.90E-01	6.76E-01	8.97E-01	9.93E-01	9.98E-01	7.39E-01

P[Nfin>Ncur] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	9.90E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.99E-01
20	7.29E-01	9.62E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.74E-01
30	2.60E-01	8.01E-01	9.63E-01	9.94E-01	1.00E+00	1.00E+00	9.06E-01
40	8.33E-02	5.15E-01	8.78E-01	9.70E-01	1.00E+00	1.00E+00	8.25E-01
50	0.00E+00	2.97E-01	6.81E-01	9.03E-01	9.93E-01	9.98E-01	7.42E-01

P[Nfin>Ncur] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
20	7.40E-01	9.62E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.75E-01
30	2.71E-01	8.12E-01	9.68E-01	9.94E-01	1.00E+00	1.00E+00	9.09E-01
40	8.33E-02	5.19E-01	8.78E-01	9.70E-01	1.00E+00	1.00E+00	8.26E-01
50	0.00E+00	2.97E-01	6.86E-01	9.03E-01	9.93E-01	9.98E-01	7.43E-01

P[N98>N93] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
10	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
20	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
30	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
40	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
50	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01

P[N98>N93] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
0	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
10	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
20	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
30	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
40	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
50	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01

P[N98>N93] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)

prob. per bin		0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
	0	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
	10	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
	20	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
	30	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
	40	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01
	50	0.00E+00	0.00E+00	0.00E+00	1.21E-01	5.81E-01	8.53E-01	4.03E-01

E[T(MSYL)|recov] 10 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
	0	2.60E+01	1.77E+01	1.18E+01	8.16E+00	4.53E+00	2.42E+00	9.10E+00
	10	2.79E+01	1.99E+01	1.32E+01	8.69E+00	4.39E+00	2.10E+00	9.77E+00
	20	2.88E+01	2.21E+01	1.58E+01	9.99E+00	4.82E+00	2.23E+00	1.04E+01
	30	2.72E+01	2.33E+01	1.88E+01	1.18E+01	5.51E+00	2.41E+00	1.04E+01
	40	2.32E+01	2.21E+01	2.14E+01	1.40E+01	6.27E+00	2.61E+00	9.83E+00
	50	1.00E+00	2.10E+01	2.37E+01	1.64E+01	7.41E+00	2.98E+00	9.45E+00

E[T(MSYL)|recov] 20 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
	0	2.60E+01	1.77E+01	1.18E+01	8.16E+00	4.53E+00	2.42E+00	9.10E+00
	10	2.79E+01	1.99E+01	1.32E+01	8.69E+00	4.39E+00	2.10E+00	9.77E+00
	20	2.88E+01	2.21E+01	1.58E+01	9.99E+00	4.82E+00	2.23E+00	1.04E+01
	30	2.72E+01	2.33E+01	1.88E+01	1.18E+01	5.51E+00	2.41E+00	1.04E+01
	40	2.32E+01	2.21E+01	2.14E+01	1.40E+01	6.27E+00	2.61E+00	9.83E+00
	50	1.00E+00	2.10E+01	2.37E+01	1.64E+01	7.41E+00	2.98E+00	9.45E+00

E[T(MSYL)|recov] 30 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.0686	0.19	0.1343	0.1179	0.1057	0.3836	
	0	2.60E+01	1.77E+01	1.18E+01	8.16E+00	4.53E+00	2.42E+00	9.10E+00
	10	2.79E+01	1.99E+01	1.32E+01	8.69E+00	4.39E+00	2.10E+00	9.77E+00
	20	2.88E+01	2.21E+01	1.58E+01	9.99E+00	4.82E+00	2.23E+00	1.04E+01
	30	2.72E+01	2.33E+01	1.88E+01	1.18E+01	5.51E+00	2.41E+00	1.04E+01
	40	2.32E+01	2.21E+01	2.14E+01	1.40E+01	6.27E+00	2.61E+00	9.83E+00
	50	1.00E+00	2.10E+01	2.37E+01	1.64E+01	7.41E+00	2.98E+00	9.45E+00

Blacktip **Baseline** Cond on r

E[cat/yr] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	

0	5.85E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.78E+01
10	6.09E+02	2.45E+00	2.45E+00	2.45E+00	2.45E+00	2.44E+00	7.28E+01
20	6.34E+02	4.87E+00	4.88E+00	4.89E+00	4.89E+00	4.89E+00	7.78E+01
30	6.57E+02	6.83E+00	6.89E+00	7.09E+00	7.11E+00	7.20E+00	8.23E+01
40	6.76E+02	7.62E+00	7.68E+00	8.10E+00	8.01E+00	9.27E+00	8.55E+01
50	6.91E+02	7.41E+00	7.60E+00	8.31E+00	7.53E+00	8.82E+00	8.71E+01

E[cat/yr] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	3.06E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.55E+01
10	3.32E+02	1.28E+00	1.28E+00	1.28E+00	1.28E+00	1.28E+00	3.96E+01
20	3.56E+02	2.37E+00	2.48E+00	2.54E+00	2.56E+00	2.56E+00	4.35E+01
30	3.74E+02	2.58E+00	2.95E+00	3.31E+00	3.50E+00	3.73E+00	4.61E+01
40	3.86E+02	2.23E+00	2.69E+00	3.39E+00	3.37E+00	4.06E+00	4.74E+01
50	3.94E+02	1.68E+00	2.22E+00	2.84E+00	2.72E+00	3.99E+00	4.79E+01

E[cat/yr] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	2.07E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E+01
10	2.34E+02	8.67E-01	8.68E-01	8.68E-01	8.68E-01	8.67E-01	2.79E+01
20	2.55E+02	1.43E+00	1.62E+00	1.71E+00	1.73E+00	1.73E+00	3.10E+01
30	2.68E+02	1.33E+00	1.79E+00	2.13E+00	2.34E+00	2.53E+00	3.28E+01
40	2.76E+02	9.55E-01	1.38E+00	2.07E+00	2.12E+00	2.73E+00	3.34E+01
50	2.79E+02	3.67E-01	1.02E+00	1.59E+00	1.65E+00	2.45E+00	3.35E+01

E[N 2008 in k] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	2.61E+03	2.03E+03	2.16E+03	2.37E+03	2.41E+03	2.62E+03	2.29E+03
10	2.36E+03	1.78E+03	1.91E+03	2.15E+03	2.19E+03	2.47E+03	2.07E+03
20	2.08E+03	1.48E+03	1.60E+03	1.83E+03	1.87E+03	2.22E+03	1.77E+03
30	1.81E+03	1.18E+03	1.28E+03	1.50E+03	1.52E+03	1.92E+03	1.46E+03
40	1.57E+03	9.08E+02	9.74E+02	1.17E+03	1.16E+03	1.57E+03	1.15E+03
50	1.36E+03	6.77E+02	7.18E+02	8.77E+02	8.54E+02	1.24E+03	8.91E+02

E[N 2018 in k] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	3.08E+03	2.87E+03	3.36E+03	3.71E+03	3.68E+03	3.33E+03	3.27E+03
10	2.51E+03	2.27E+03	2.83E+03	3.30E+03	3.38E+03	3.19E+03	2.81E+03
20	1.92E+03	1.59E+03	2.13E+03	2.71E+03	2.90E+03	2.98E+03	2.23E+03

30	1.45E+03	9.92E+02	1.42E+03	1.98E+03	2.19E+03	2.65E+03	1.63E+03
40	1.08E+03	5.70E+02	8.62E+02	1.32E+03	1.44E+03	1.98E+03	1.09E+03
50	8.03E+02	2.94E+02	4.82E+02	8.15E+02	9.22E+02	1.44E+03	6.92E+02

E[N 2028 in k] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	3.60E+03	3.74E+03	4.31E+03	4.39E+03	4.09E+03	3.44E+03	3.94E+03
10	2.68E+03	2.82E+03	3.67E+03	4.03E+03	3.88E+03	3.32E+03	3.34E+03
20	1.81E+03	1.74E+03	2.68E+03	3.42E+03	3.51E+03	3.18E+03	2.58E+03
30	1.18E+03	9.01E+02	1.62E+03	2.44E+03	2.73E+03	2.92E+03	1.78E+03
40	7.61E+02	3.88E+02	8.62E+02	1.53E+03	1.71E+03	2.23E+03	1.09E+03
50	4.78E+02	1.31E+02	3.71E+02	8.53E+02	1.04E+03	1.55E+03	6.16E+02

E[N 2008 / K] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	3.00E-01	3.20E-01	4.07E-01	5.02E-01	5.71E-01	7.60E-01	4.50E-01
10	2.68E-01	2.79E-01	3.60E-01	4.54E-01	5.20E-01	7.16E-01	4.06E-01
20	2.33E-01	2.31E-01	3.00E-01	3.85E-01	4.41E-01	6.42E-01	3.47E-01
30	1.99E-01	1.83E-01	2.38E-01	3.12E-01	3.55E-01	5.52E-01	2.85E-01
40	1.68E-01	1.40E-01	1.80E-01	2.41E-01	2.68E-01	4.45E-01	2.22E-01
50	1.43E-01	1.03E-01	1.32E-01	1.79E-01	1.94E-01	3.47E-01	1.69E-01

E[N 2018 / K] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	3.59E-01	4.54E-01	6.34E-01	7.86E-01	8.76E-01	9.68E-01	6.45E-01
10	2.86E-01	3.58E-01	5.32E-01	6.99E-01	8.03E-01	9.26E-01	5.61E-01
20	2.11E-01	2.47E-01	3.98E-01	5.71E-01	6.87E-01	8.66E-01	4.53E-01
30	1.53E-01	1.52E-01	2.63E-01	4.13E-01	5.15E-01	7.68E-01	3.37E-01
40	1.10E-01	8.62E-02	1.58E-01	2.71E-01	3.32E-01	5.65E-01	2.23E-01
50	7.91E-02	4.41E-02	8.72E-02	1.63E-01	2.06E-01	4.01E-01	1.41E-01

E[N 2028 / K] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	4.22E-01	5.92E-01	8.12E-01	9.31E-01	9.75E-01	9.97E-01	7.65E-01
10	3.05E-01	4.45E-01	6.89E-01	8.54E-01	9.23E-01	9.62E-01	6.62E-01
20	1.96E-01	2.69E-01	5.00E-01	7.22E-01	8.35E-01	9.22E-01	5.25E-01
30	1.21E-01	1.37E-01	2.99E-01	5.10E-01	6.44E-01	8.47E-01	3.74E-01
40	7.48E-02	5.83E-02	1.57E-01	3.12E-01	3.95E-01	6.36E-01	2.33E-01
50	4.62E-02	1.98E-02	6.60E-02	1.69E-01	2.31E-01	4.34E-01	1.34E-01

P[Extinct] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.40E-03	2.00E-04
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.40E-03	2.00E-04
20	1.72E-03	5.15E-03	3.42E-03	1.36E-03	0.00E+00	1.40E-03	2.80E-03
30	7.41E-02	6.99E-02	6.15E-02	3.41E-02	3.18E-02	1.95E-02	5.26E-02
40	2.05E-01	2.21E-01	2.15E-01	1.72E-01	1.82E-01	5.30E-02	1.83E-01
50	3.16E-01	3.94E-01	3.79E-01	3.21E-01	3.84E-01	2.79E-01	3.53E-01

P[Extinct] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.40E-03	2.00E-04
10	1.72E-03	7.35E-04	0.00E+00	0.00E+00	0.00E+00	1.40E-03	6.00E-04
20	1.47E-01	7.43E-02	3.08E-02	9.55E-03	0.00E+00	1.40E-03	4.60E-02
30	3.22E-01	3.28E-01	2.33E-01	1.39E-01	8.86E-02	2.93E-02	2.13E-01
40	4.85E-01	5.65E-01	4.76E-01	3.38E-01	3.43E-01	2.08E-01	4.31E-01
50	6.31E-01	7.38E-01	6.53E-01	5.57E-01	5.75E-01	3.77E-01	6.13E-01

P[Extinct] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.40E-03	2.00E-04
10	3.45E-03	7.35E-04	0.00E+00	0.00E+00	0.00E+00	1.40E-03	8.00E-04
20	2.78E-01	1.75E-01	6.75E-02	1.77E-02	2.27E-03	1.40E-03	9.86E-02
30	4.74E-01	4.90E-01	3.12E-01	1.81E-01	1.02E-01	2.93E-02	3.01E-01
40	6.55E-01	7.25E-01	6.02E-01	4.05E-01	3.89E-01	2.13E-01	5.38E-01
50	7.66E-01	9.15E-01	7.66E-01	6.34E-01	6.21E-01	4.37E-01	7.27E-01

P[Nfin<0.2K] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	2.85E-01	1.35E-01	3.42E-02	1.36E-03	0.00E+00	1.40E-03	7.80E-02
10	3.85E-01	2.89E-01	1.17E-01	2.46E-02	4.55E-03	1.40E-03	1.55E-01
20	4.64E-01	4.38E-01	2.72E-01	1.31E-01	7.27E-02	4.18E-03	2.63E-01
30	5.31E-01	5.83E-01	4.40E-01	2.70E-01	2.32E-01	4.32E-02	3.89E-01
40	6.14E-01	6.84E-01	5.73E-01	4.39E-01	4.30E-01	2.46E-01	5.29E-01
50	6.81E-01	7.97E-01	6.90E-01	5.70E-01	5.96E-01	4.28E-01	6.55E-01

P[Nfin<0.2K] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	1.16E-01	1.91E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.86E-02
10	3.59E-01	1.49E-01	1.88E-02	1.36E-03	0.00E+00	1.40E-03	8.70E-02
20	5.00E-01	4.13E-01	1.82E-01	4.78E-02	1.59E-02	1.40E-03	2.22E-01
30	6.31E-01	6.44E-01	4.26E-01	2.42E-01	1.57E-01	2.93E-02	4.01E-01
40	7.41E-01	8.17E-01	6.39E-01	4.54E-01	4.23E-01	2.20E-01	5.93E-01
50	7.81E-01	9.38E-01	7.89E-01	6.47E-01	6.25E-01	4.41E-01	7.43E-01

P[Nfin<0.2K] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	6.21E-02	7.35E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.40E-03
10	3.31E-01	9.12E-02	2.56E-03	0.00E+00	0.00E+00	1.40E-03	6.40E-02
20	5.24E-01	3.97E-01	1.45E-01	2.05E-02	6.82E-03	1.40E-03	2.07E-01
30	7.03E-01	6.82E-01	4.28E-01	2.31E-01	1.16E-01	2.93E-02	4.15E-01
40	7.85E-01	8.83E-01	6.68E-01	4.63E-01	4.11E-01	2.19E-01	6.23E-01
50	9.79E-01	9.82E-01	8.21E-01	6.79E-01	6.39E-01	4.41E-01	7.92E-01

P[Nfin>MSYL] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	5.69E-02	5.07E-02	2.56E-01	5.20E-01	6.93E-01	9.69E-01	3.56E-01
10	2.59E-02	1.91E-02	1.79E-01	4.07E-01	5.27E-01	9.12E-01	2.87E-01
20	2.07E-02	0.00E+00	1.20E-01	2.74E-01	3.55E-01	7.78E-01	2.13E-01
30	6.90E-03	0.00E+00	0.00E+00	1.39E-01	2.39E-01	5.38E-01	1.19E-01
40	1.72E-03	0.00E+00	0.00E+00	8.05E-02	1.75E-01	4.18E-01	8.74E-02
50	0.00E+00	0.00E+00	0.00E+00	6.82E-03	1.32E-01	3.47E-01	6.24E-02

P[Nfin>MSYL] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	1.16E-01	3.83E-01	8.29E-01	9.95E-01	1.00E+00	1.00E+00	6.89E-01
10	6.03E-02	1.94E-01	5.97E-01	9.13E-01	9.93E-01	9.99E-01	5.64E-01
20	2.24E-02	4.71E-02	3.37E-01	6.94E-01	8.84E-01	9.96E-01	4.17E-01
30	0.00E+00	0.00E+00	1.81E-01	4.49E-01	5.98E-01	9.36E-01	2.95E-01
40	0.00E+00	0.00E+00	2.05E-02	2.59E-01	3.57E-01	6.79E-01	1.72E-01
50	0.00E+00	0.00E+00	0.00E+00	9.96E-02	2.25E-01	4.62E-01	1.01E-01

P[Nfin>MSYL] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)

prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	3.76E-01	7.39E-01	9.97E-01	1.00E+00	1.00E+00	1.00E+00	8.56E-01
10	7.41E-02	4.18E-01	8.79E-01	9.99E-01	1.00E+00	9.99E-01	7.05E-01
20	2.41E-02	1.53E-01	5.91E-01	9.00E-01	9.82E-01	9.99E-01	5.44E-01
30	0.00E+00	1.69E-02	3.01E-01	6.49E-01	7.96E-01	9.68E-01	3.79E-01
40	0.00E+00	0.00E+00	6.58E-02	3.68E-01	4.98E-01	7.66E-01	2.23E-01
50	0.00E+00	0.00E+00	1.11E-02	1.58E-01	2.71E-01	5.27E-01	1.25E-01

P[Nfin>Ncur] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	6.35E-01	9.24E-01	9.97E-01	9.99E-01	1.00E+00	9.99E-01	9.36E-01
20	6.90E-02	4.98E-01	8.37E-01	9.69E-01	9.86E-01	9.99E-01	7.11E-01
30	0.00E+00	1.51E-01	5.01E-01	7.54E-01	8.46E-01	9.68E-01	4.82E-01
40	0.00E+00	1.32E-02	2.47E-01	4.86E-01	5.52E-01	7.69E-01	2.91E-01
50	0.00E+00	0.00E+00	2.74E-02	2.84E-01	3.39E-01	5.43E-01	1.56E-01

P[Nfin>Ncur] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	7.43E-01	9.60E-01	9.99E-01	1.00E+00	1.00E+00	9.99E-01	9.59E-01
20	1.10E-01	5.62E-01	8.77E-01	9.82E-01	9.96E-01	9.99E-01	7.46E-01
30	1.72E-03	1.83E-01	5.36E-01	7.72E-01	8.84E-01	9.71E-01	5.06E-01
40	0.00E+00	1.32E-02	2.76E-01	5.13E-01	5.73E-01	7.80E-01	3.06E-01
50	0.00E+00	0.00E+00	3.42E-02	2.97E-01	3.46E-01	5.57E-01	1.62E-01

P[Nfin>Ncur] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	7.69E-01	9.66E-01	1.00E+00	1.00E+00	1.00E+00	9.99E-01	9.64E-01
20	1.26E-01	5.82E-01	8.83E-01	9.82E-01	9.98E-01	9.99E-01	7.55E-01
30	1.72E-03	1.90E-01	5.60E-01	7.82E-01	8.89E-01	9.71E-01	5.15E-01
40	0.00E+00	1.32E-02	2.85E-01	5.23E-01	5.82E-01	7.82E-01	3.10E-01
50	0.00E+00	0.00E+00	5.81E-02	2.99E-01	3.48E-01	5.57E-01	1.68E-01

P[N98>N93] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	

0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02

P[N98>N93] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02

P[N98>N93] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02
50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	8.79E-02	1.28E-02

E[T(MSYL)|recov] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	2.72E+01	2.28E+01	1.48E+01	1.05E+01	8.76E+00	5.64E+00	1.59E+01
10	2.92E+01	2.66E+01	1.87E+01	1.25E+01	9.98E+00	6.02E+00	1.82E+01
20	2.60E+01	2.88E+01	2.29E+01	1.64E+01	1.30E+01	7.30E+00	1.89E+01
30	3.50E+00	3.06E+01	2.47E+01	1.91E+01	1.65E+01	9.12E+00	1.85E+01
40	1.00E+00	3.10E+01	2.91E+01	2.14E+01	1.74E+01	1.04E+01	1.84E+01
50	1.00E+00	0.00E+00	2.99E+01	2.47E+01	1.69E+01	9.63E+00	1.64E+01

E[T(MSYL)|recov] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	2.72E+01	2.28E+01	1.48E+01	1.05E+01	8.76E+00	5.64E+00	1.59E+01
10	2.92E+01	2.66E+01	1.87E+01	1.25E+01	9.98E+00	6.02E+00	1.82E+01
20	2.60E+01	2.88E+01	2.29E+01	1.64E+01	1.30E+01	7.30E+00	1.89E+01

30	3.50E+00	3.06E+01	2.47E+01	1.91E+01	1.65E+01	9.12E+00	1.85E+01
40	1.00E+00	3.10E+01	2.91E+01	2.14E+01	1.74E+01	1.04E+01	1.84E+01
50	1.00E+00	0.00E+00	2.99E+01	2.47E+01	1.69E+01	9.63E+00	1.64E+01

E[T(MSYL)|recov] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.116	0.272	0.234	0.1466	0.088	0.1434	
0	2.72E+01	2.28E+01	1.48E+01	1.05E+01	8.76E+00	5.64E+00	1.59E+01
10	2.92E+01	2.66E+01	1.87E+01	1.25E+01	9.98E+00	6.02E+00	1.82E+01
20	2.60E+01	2.88E+01	2.29E+01	1.64E+01	1.30E+01	7.30E+00	1.89E+01
30	3.50E+00	3.06E+01	2.47E+01	1.91E+01	1.65E+01	9.12E+00	1.85E+01
40	1.00E+00	3.10E+01	2.91E+01	2.14E+01	1.74E+01	1.04E+01	1.84E+01
50	1.00E+00	0.00E+00	2.99E+01	2.47E+01	1.69E+01	9.63E+00	1.64E+01

Blacktip **Alt Catch** Cond on r

E[cat/yr] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	6.67E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.57E+01
10	6.92E+02	2.45E+00	2.45E+00	2.45E+00	2.45E+00	2.45E+00	9.09E+01
20	7.16E+02	4.89E+00	4.89E+00	4.89E+00	4.88E+00	4.89E+00	9.62E+01
30	7.40E+02	7.09E+00	7.18E+00	7.24E+00	7.17E+00	7.29E+00	1.01E+02
40	7.61E+02	8.20E+00	8.52E+00	8.47E+00	8.24E+00	9.45E+00	1.05E+02
50	7.79E+02	7.86E+00	8.66E+00	8.52E+00	7.83E+00	1.10E+01	1.08E+02

E[cat/yr] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	3.49E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.49E+01
10	3.75E+02	1.28E+00	1.28E+00	1.28E+00	1.28E+00	1.28E+00	4.93E+01
20	4.00E+02	2.46E+00	2.54E+00	2.56E+00	2.56E+00	2.56E+00	5.36E+01
30	4.20E+02	2.80E+00	3.30E+00	3.51E+00	3.60E+00	3.81E+00	5.67E+01
40	4.34E+02	2.45E+00	3.24E+00	3.55E+00	3.67E+00	4.83E+00	5.86E+01
50	4.44E+02	1.80E+00	2.75E+00	2.93E+00	3.20E+00	5.23E+00	5.95E+01

E[cat/yr] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	2.37E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E+01
10	2.63E+02	8.68E-01	8.68E-01	8.68E-01	8.68E-01	8.68E-01	3.45E+01
20	2.86E+02	1.54E+00	1.69E+00	1.74E+00	1.73E+00	1.74E+00	3.81E+01
30	3.01E+02	1.45E+00	2.03E+00	2.30E+00	2.39E+00	2.58E+00	4.04E+01
40	3.11E+02	1.07E+00	1.81E+00	2.08E+00	2.27E+00	3.25E+00	4.15E+01
50	3.17E+02	4.13E-01	1.35E+00	1.65E+00	1.88E+00	3.48E+00	4.19E+01

E[N 2008 in k] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	2.82E+03	2.13E+03	2.43E+03	2.57E+03	2.66E+03	2.96E+03	2.50E+03
10	2.57E+03	1.88E+03	2.20E+03	2.35E+03	2.44E+03	2.82E+03	2.27E+03
20	2.30E+03	1.58E+03	1.88E+03	2.02E+03	2.10E+03	2.55E+03	1.97E+03
30	2.02E+03	1.27E+03	1.55E+03	1.66E+03	1.72E+03	2.22E+03	1.65E+03
40	1.76E+03	9.82E+02	1.23E+03	1.31E+03	1.34E+03	1.84E+03	1.33E+03
50	1.53E+03	7.29E+02	9.43E+02	9.94E+02	1.01E+03	1.40E+03	1.03E+03

E[N 2018 in k] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	3.35E+03	3.07E+03	3.87E+03	4.23E+03	4.31E+03	3.95E+03	3.65E+03
10	2.78E+03	2.46E+03	3.33E+03	3.80E+03	3.98E+03	3.81E+03	3.18E+03
20	2.18E+03	1.76E+03	2.62E+03	3.17E+03	3.46E+03	3.62E+03	2.58E+03
30	1.66E+03	1.10E+03	1.86E+03	2.36E+03	2.69E+03	3.34E+03	1.94E+03
40	1.25E+03	6.34E+02	1.21E+03	1.59E+03	1.85E+03	2.90E+03	1.37E+03
50	9.30E+02	3.28E+02	7.37E+02	1.03E+03	1.21E+03	2.24E+03	9.22E+02

E[N 2028 in k] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	3.93E+03	4.08E+03	5.03E+03	5.15E+03	4.88E+03	4.08E+03	4.48E+03
10	3.01E+03	3.14E+03	4.38E+03	4.77E+03	4.66E+03	3.97E+03	3.84E+03
20	2.08E+03	1.99E+03	3.40E+03	4.15E+03	4.29E+03	3.84E+03	3.03E+03
30	1.39E+03	1.03E+03	2.24E+03	3.05E+03	3.47E+03	3.65E+03	2.16E+03
40	8.87E+02	4.46E+02	1.30E+03	1.91E+03	2.32E+03	3.27E+03	1.42E+03
50	5.29E+02	1.55E+02	6.69E+02	1.17E+03	1.45E+03	2.67E+03	8.97E+02

E[N 2008 / K] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	2.83E-01	2.92E-01	3.87E-01	4.59E-01	5.26E-01	7.27E-01	4.12E-01
10	2.56E-01	2.57E-01	3.49E-01	4.18E-01	4.83E-01	6.92E-01	3.76E-01
20	2.25E-01	2.15E-01	2.97E-01	3.58E-01	4.13E-01	6.24E-01	3.25E-01
30	1.95E-01	1.73E-01	2.45E-01	2.93E-01	3.37E-01	5.43E-01	2.72E-01
40	1.67E-01	1.33E-01	1.93E-01	2.29E-01	2.59E-01	4.48E-01	2.16E-01
50	1.43E-01	9.78E-02	1.47E-01	1.72E-01	1.92E-01	3.36E-01	1.65E-01

E[N 2018 / K] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	3.40E-01	4.22E-01	6.15E-01	7.57E-01	8.55E-01	9.68E-01	6.07E-01
10	2.77E-01	3.37E-01	5.28E-01	6.79E-01	7.90E-01	9.35E-01	5.34E-01
20	2.10E-01	2.39E-01	4.14E-01	5.63E-01	6.85E-01	8.88E-01	4.41E-01
30	1.55E-01	1.48E-01	2.92E-01	4.16E-01	5.30E-01	8.20E-01	3.39E-01
40	1.14E-01	8.44E-02	1.88E-01	2.75E-01	3.58E-01	7.11E-01	2.44E-01
50	8.25E-02	4.30E-02	1.13E-01	1.76E-01	2.29E-01	5.47E-01	1.65E-01

E[N 2028 / K] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	4.02E-01	5.61E-01	8.01E-01	9.20E-01	9.70E-01	9.97E-01	7.33E-01
10	3.00E-01	4.30E-01	6.96E-01	8.52E-01	9.25E-01	9.70E-01	6.41E-01
20	1.98E-01	2.70E-01	5.38E-01	7.39E-01	8.50E-01	9.39E-01	5.19E-01
30	1.27E-01	1.38E-01	3.51E-01	5.38E-01	6.85E-01	8.93E-01	3.83E-01
40	7.85E-02	5.88E-02	2.01E-01	3.32E-01	4.52E-01	8.02E-01	2.62E-01
50	4.63E-02	2.04E-02	1.02E-01	1.99E-01	2.74E-01	6.52E-01	1.72E-01

P[Extinct] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	0.00E+00	0.00E+00	8.83E-04	0.00E+00	2.63E-03	0.00E+00	4.00E-04
30	4.52E-02	3.39E-02	2.21E-02	1.39E-02	2.36E-02	7.21E-03	2.56E-02
40	1.51E-01	1.62E-01	1.29E-01	1.35E-01	1.58E-01	3.46E-02	1.32E-01
50	2.57E-01	3.58E-01	2.92E-01	3.03E-01	3.60E-01	1.05E-01	2.88E-01

P[Extinct] 20 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	5.14E-02	3.99E-02	8.83E-03	0.00E+00	2.63E-03	0.00E+00	2.08E-02
30	2.63E-01	2.72E-01	1.42E-01	8.82E-02	6.30E-02	1.01E-02	1.65E-01
40	4.16E-01	5.23E-01	3.68E-01	3.08E-01	2.84E-01	5.76E-02	3.63E-01
50	5.39E-01	7.19E-01	5.71E-01	5.43E-01	5.01E-01	1.84E-01	5.49E-01

P[Extinct] 30 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)

		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	10	3.12E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-04
	20	2.03E-01	1.12E-01	2.47E-02	0.00E+00	2.63E-03	0.00E+00	6.56E-02
	30	4.13E-01	4.45E-01	2.20E-01	1.18E-01	8.40E-02	1.01E-02	2.60E-01
	40	5.86E-01	6.93E-01	4.79E-01	4.03E-01	3.47E-01	6.48E-02	4.80E-01
	50	6.78E-01	9.05E-01	6.88E-01	6.19E-01	5.67E-01	1.99E-01	6.66E-01

P[Nfin<0.2K] 10 -year

value for r

		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
	0	2.79E-01	1.86E-01	4.06E-02	1.55E-03	2.63E-03	0.00E+00	1.01E-01
	10	3.75E-01	3.32E-01	1.13E-01	2.63E-02	7.87E-03	0.00E+00	1.78E-01
	20	4.63E-01	4.86E-01	2.53E-01	1.38E-01	7.61E-02	7.21E-03	2.88E-01
	30	5.25E-01	6.06E-01	4.07E-01	3.19E-01	2.44E-01	3.60E-02	4.07E-01
	40	5.86E-01	7.15E-01	5.53E-01	4.89E-01	4.28E-01	9.80E-02	5.25E-01
	50	6.32E-01	8.33E-01	6.51E-01	6.19E-01	5.96E-01	2.16E-01	6.35E-01

P[Nfin<0.2K] 20 -year

value for r

		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
	0	1.22E-01	2.39E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.28E-02
	10	3.30E-01	1.63E-01	8.83E-03	0.00E+00	0.00E+00	0.00E+00	9.34E-02
	20	4.89E-01	4.36E-01	1.30E-01	1.86E-02	7.87E-03	0.00E+00	2.26E-01
	30	5.95E-01	6.47E-01	3.64E-01	2.07E-01	1.26E-01	1.15E-02	3.91E-01
	40	6.73E-01	8.34E-01	5.74E-01	4.61E-01	3.68E-01	7.06E-02	5.65E-01
	50	7.18E-01	9.59E-01	7.24E-01	6.53E-01	5.85E-01	2.06E-01	7.02E-01

P[Nfin<0.2K] 30 -year

value for r

		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
	0	2.49E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.20E-03
	10	2.84E-01	8.38E-02	8.83E-04	0.00E+00	0.00E+00	0.00E+00	6.18E-02
	20	5.09E-01	3.90E-01	8.74E-02	7.74E-03	2.63E-03	0.00E+00	2.04E-01
	30	6.40E-01	6.67E-01	3.35E-01	1.81E-01	9.71E-02	1.01E-02	3.91E-01
	40	9.41E-01	8.90E-01	5.85E-01	4.54E-01	3.60E-01	6.63E-02	6.16E-01
	50	9.94E-01	9.73E-01	7.41E-01	6.55E-01	5.80E-01	2.02E-01	7.45E-01

P[Nfin>MSYL] 10 -year

value for r

	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	

0	1.40E-02	0.00E+00	2.25E-01	3.45E-01	5.35E-01	9.63E-01	2.72E-01
10	1.09E-02	0.00E+00	1.88E-01	2.86E-01	4.25E-01	9.37E-01	2.43E-01
20	7.79E-03	0.00E+00	1.77E-02	1.95E-01	2.70E-01	8.26E-01	1.65E-01
30	3.12E-03	0.00E+00	9.71E-03	1.49E-01	1.84E-01	7.03E-01	1.33E-01
40	3.12E-03	0.00E+00	0.00E+00	7.12E-02	1.47E-01	2.84E-01	6.02E-02
50	1.56E-03	0.00E+00	0.00E+00	2.32E-02	1.18E-01	2.33E-01	4.46E-02

P[Nfin>MSYL] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	7.01E-02	2.95E-01	8.10E-01	9.92E-01	1.00E+00	1.00E+00	6.24E-01
10	2.18E-02	1.19E-01	5.90E-01	9.18E-01	9.95E-01	1.00E+00	5.05E-01
20	7.79E-03	1.46E-02	3.59E-01	6.56E-01	8.87E-01	9.93E-01	3.77E-01
30	1.56E-03	0.00E+00	2.15E-01	4.04E-01	6.19E-01	9.67E-01	2.82E-01
40	0.00E+00	0.00E+00	4.06E-02	2.40E-01	3.91E-01	8.78E-01	1.92E-01
50	0.00E+00	0.00E+00	3.53E-03	1.41E-01	2.18E-01	7.26E-01	1.36E-01

P[Nfin>MSYL] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	1.59E-01	6.72E-01	9.99E-01	1.00E+00	1.00E+00	1.00E+00	7.93E-01
10	5.61E-02	3.69E-01	9.11E-01	1.00E+00	1.00E+00	1.00E+00	6.69E-01
20	6.23E-03	1.21E-01	6.40E-01	9.24E-01	9.84E-01	1.00E+00	5.15E-01
30	1.56E-03	1.13E-02	3.58E-01	6.50E-01	8.48E-01	9.89E-01	3.71E-01
40	0.00E+00	0.00E+00	1.53E-01	3.90E-01	5.62E-01	9.27E-01	2.56E-01
50	0.00E+00	0.00E+00	3.09E-02	2.18E-01	3.31E-01	7.84E-01	1.69E-01

P[Nfin>Ncur] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	7.23E-01	9.59E-01	9.99E-01	1.00E+00	1.00E+00	1.00E+00	9.52E-01
20	8.72E-02	5.72E-01	9.19E-01	9.88E-01	9.95E-01	1.00E+00	7.34E-01
30	0.00E+00	2.13E-01	6.42E-01	8.14E-01	8.92E-01	9.89E-01	5.20E-01
40	0.00E+00	1.40E-02	3.68E-01	5.26E-01	6.38E-01	9.34E-01	3.34E-01
50	0.00E+00	0.00E+00	1.17E-01	3.28E-01	4.09E-01	7.94E-01	2.10E-01

P[Nfin>Ncur] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
10	8.05E-01	9.83E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.70E-01
20	1.26E-01	6.30E-01	9.44E-01	9.95E-01	9.97E-01	1.00E+00	7.63E-01

30	0.00E+00	2.50E-01	6.67E-01	8.36E-01	9.03E-01	9.90E-01	5.41E-01
40	0.00E+00	2.33E-02	3.81E-01	5.51E-01	6.40E-01	9.34E-01	3.43E-01
50	0.00E+00	0.00E+00	1.72E-01	3.39E-01	4.20E-01	7.98E-01	2.26E-01

P[Nfin>Ncur] 30 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
	0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
	10	8.30E-01	9.89E-01	1.00E+00	1.00E+00	1.00E+00	1.00E+00	9.75E-01
	20	1.43E-01	6.54E-01	9.51E-01	9.97E-01	9.97E-01	1.00E+00	7.74E-01
	30	4.67E-03	2.59E-01	6.78E-01	8.45E-01	9.11E-01	9.90E-01	5.48E-01
	40	0.00E+00	2.39E-02	3.87E-01	5.57E-01	6.43E-01	9.35E-01	3.46E-01
	50	0.00E+00	0.00E+00	1.73E-01	3.42E-01	4.20E-01	7.98E-01	2.26E-01

P[N98>N93] 10 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02

P[N98>N93] 20 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02

P[N98>N93] 30 -year

		value for r						
		<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin		0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	40	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02
	50	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	8.79E-02	1.42E-02

E[T(MSYL)|recov] 10 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	2.94E+01	2.46E+01	1.56E+01	1.18E+01	9.88E+00	6.66E+00	1.79E+01
10	3.03E+01	2.79E+01	1.90E+01	1.37E+01	1.10E+01	7.08E+00	1.99E+01
20	2.93E+01	2.99E+01	2.31E+01	1.75E+01	1.37E+01	8.24E+00	2.05E+01
30	1.39E+01	3.09E+01	2.53E+01	2.07E+01	1.69E+01	9.57E+00	2.02E+01
40	1.00E+00	3.10E+01	2.81E+01	2.16E+01	1.79E+01	1.15E+01	1.91E+01
50	1.00E+00	0.00E+00	2.98E+01	2.26E+01	1.88E+01	1.40E+01	1.90E+01

E[T(MSYL)|recov] 20 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	2.94E+01	2.46E+01	1.56E+01	1.18E+01	9.88E+00	6.66E+00	1.79E+01
10	3.03E+01	2.79E+01	1.90E+01	1.37E+01	1.10E+01	7.08E+00	1.99E+01
20	2.93E+01	2.99E+01	2.31E+01	1.75E+01	1.37E+01	8.24E+00	2.05E+01
30	1.39E+01	3.09E+01	2.53E+01	2.07E+01	1.69E+01	9.57E+00	2.02E+01
40	1.00E+00	3.10E+01	2.81E+01	2.16E+01	1.79E+01	1.15E+01	1.91E+01
50	1.00E+00	0.00E+00	2.98E+01	2.26E+01	1.88E+01	1.40E+01	1.90E+01

E[T(MSYL)|recov] 30 -year

	value for r						
	<0.0400	0.04	0.08	0.12	0.16	0.2000+	E(X)
prob. per bin	0.1284	0.3008	0.2266	0.1292	0.0762	0.1388	
0	2.94E+01	2.46E+01	1.56E+01	1.18E+01	9.88E+00	6.66E+00	1.79E+01
10	3.03E+01	2.79E+01	1.90E+01	1.37E+01	1.10E+01	7.08E+00	1.99E+01
20	2.93E+01	2.99E+01	2.31E+01	1.75E+01	1.37E+01	8.24E+00	2.05E+01
30	1.39E+01	3.09E+01	2.53E+01	2.07E+01	1.69E+01	9.57E+00	2.02E+01
40	1.00E+00	3.10E+01	2.81E+01	2.16E+01	1.79E+01	1.15E+01	1.91E+01
50	1.00E+00	0.00E+00	2.98E+01	2.26E+01	1.88E+01	1.40E+01	1.90E+01

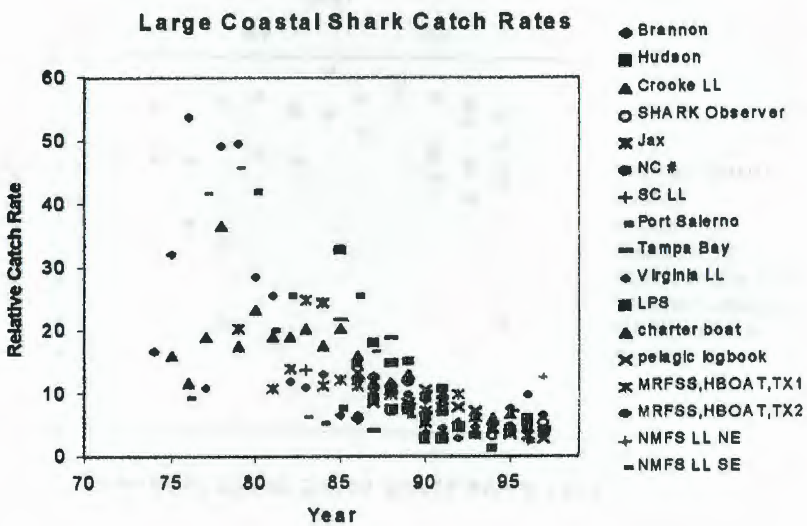
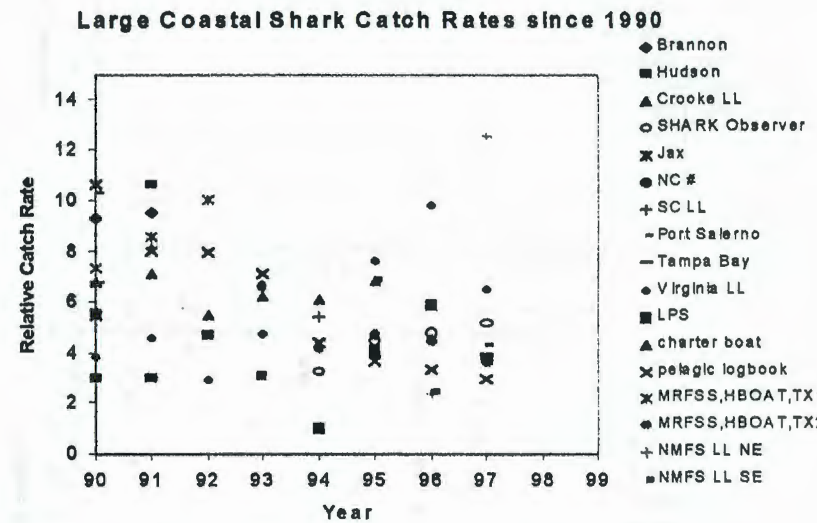
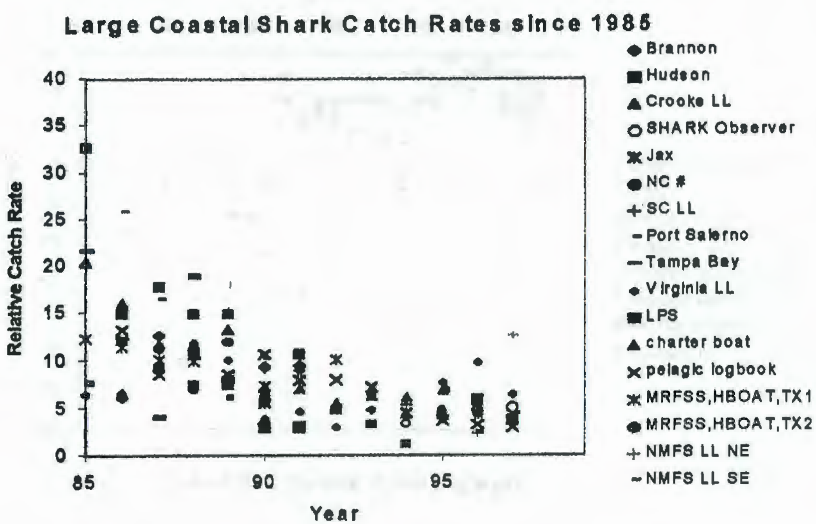
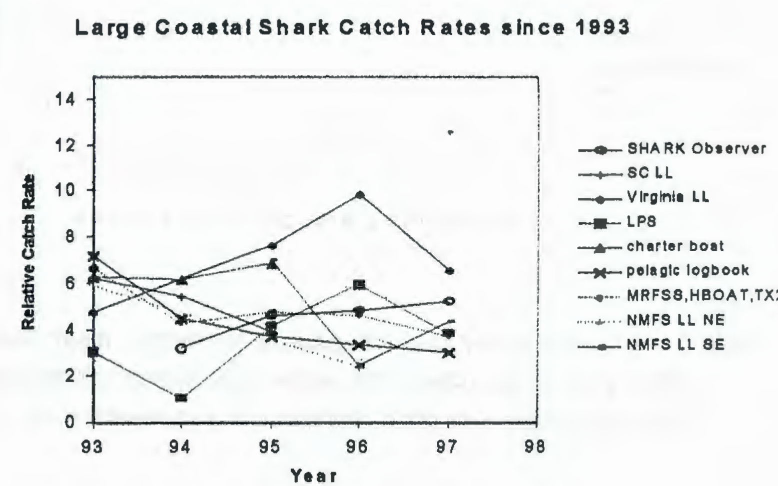


Figure 1.1. Four views of the available catch rate information for large coastal sharks. Available time series have been adjusted through a Generalized Linear Modeling procedure so as to appear on a common scale.







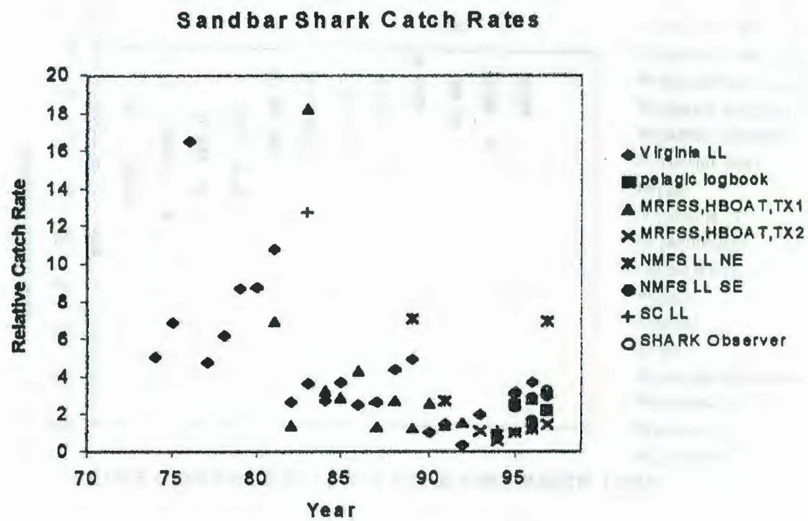
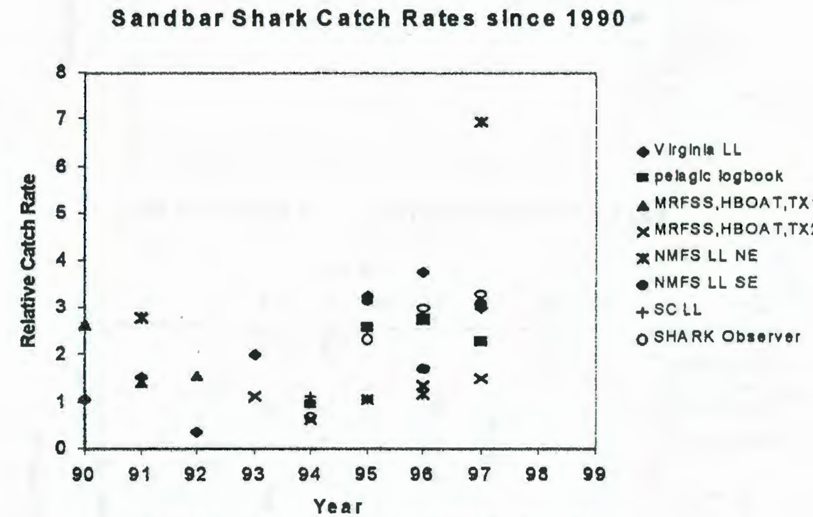
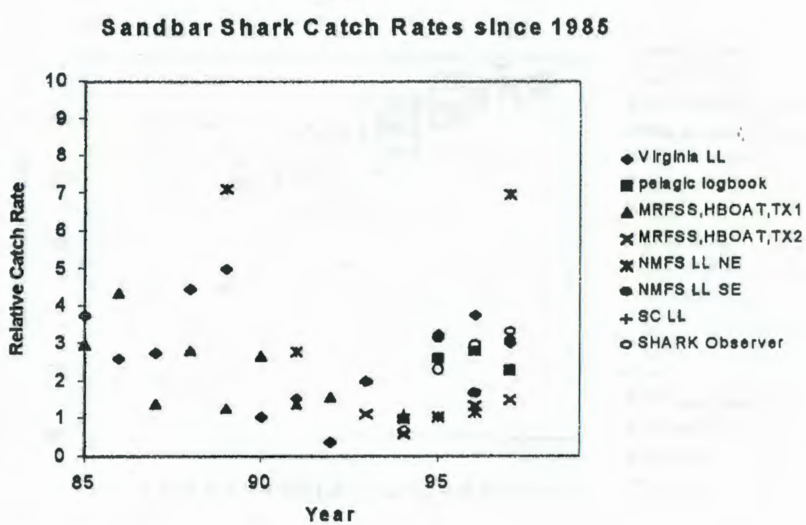


Figure 1.2. Four views of the available catch rate information for sandbar sharks. Available time series have been adjusted through a Generalized Linear Modeling procedure so as to appear on a common scale.





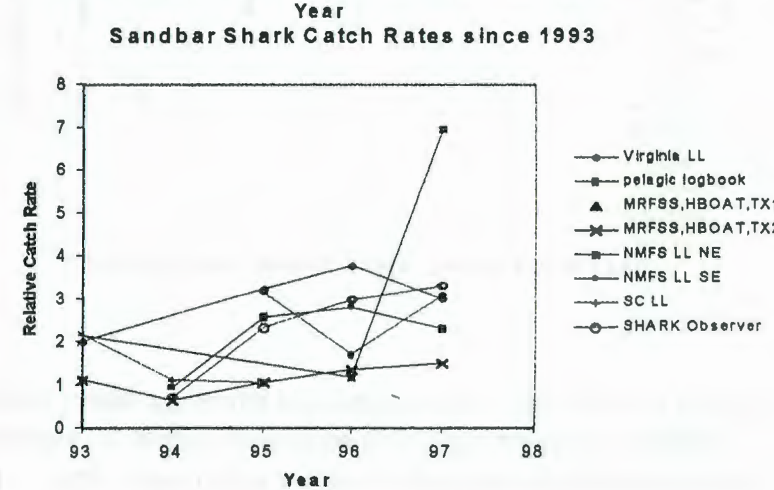
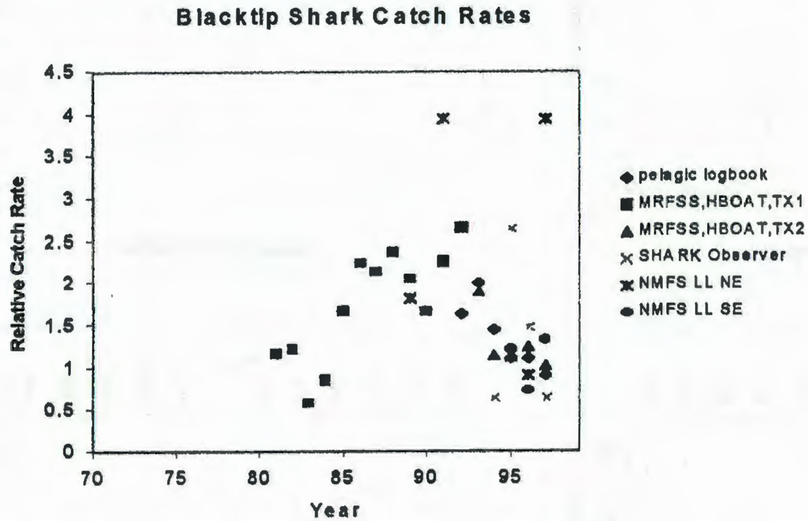
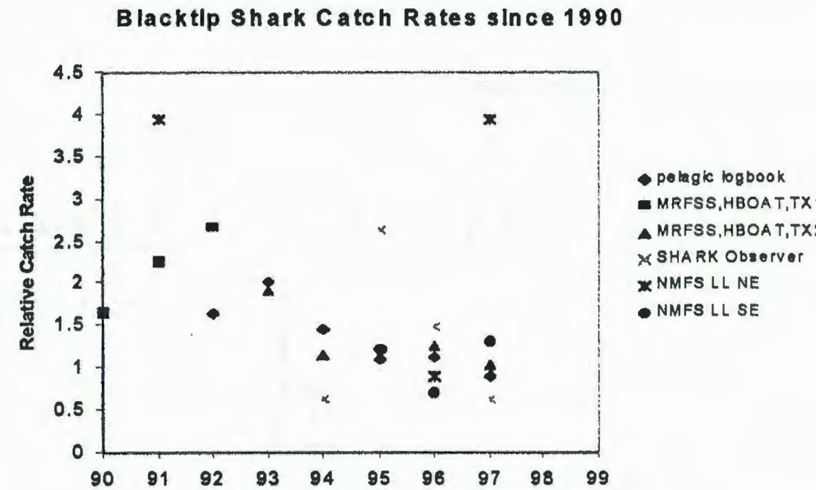
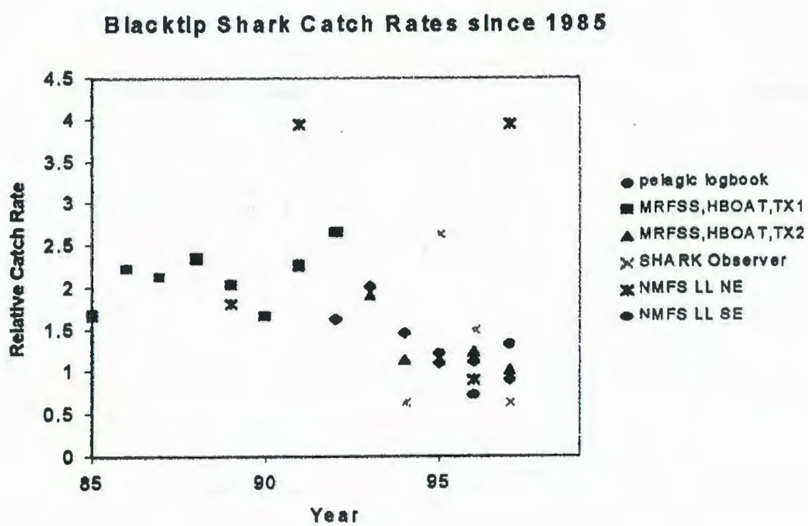


Figure 1.3. Four views of the available catch rate information for blacktip sharks. Available time series have been adjusted through a Generalized Linear Modeling procedure so as to appear on a common scale.







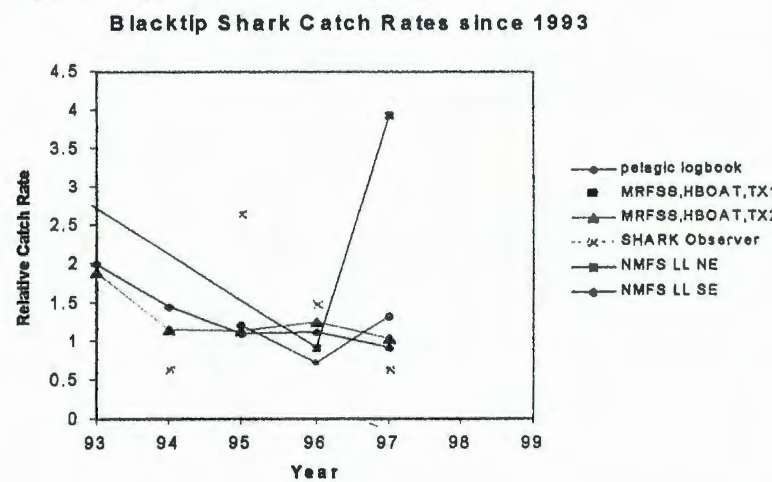
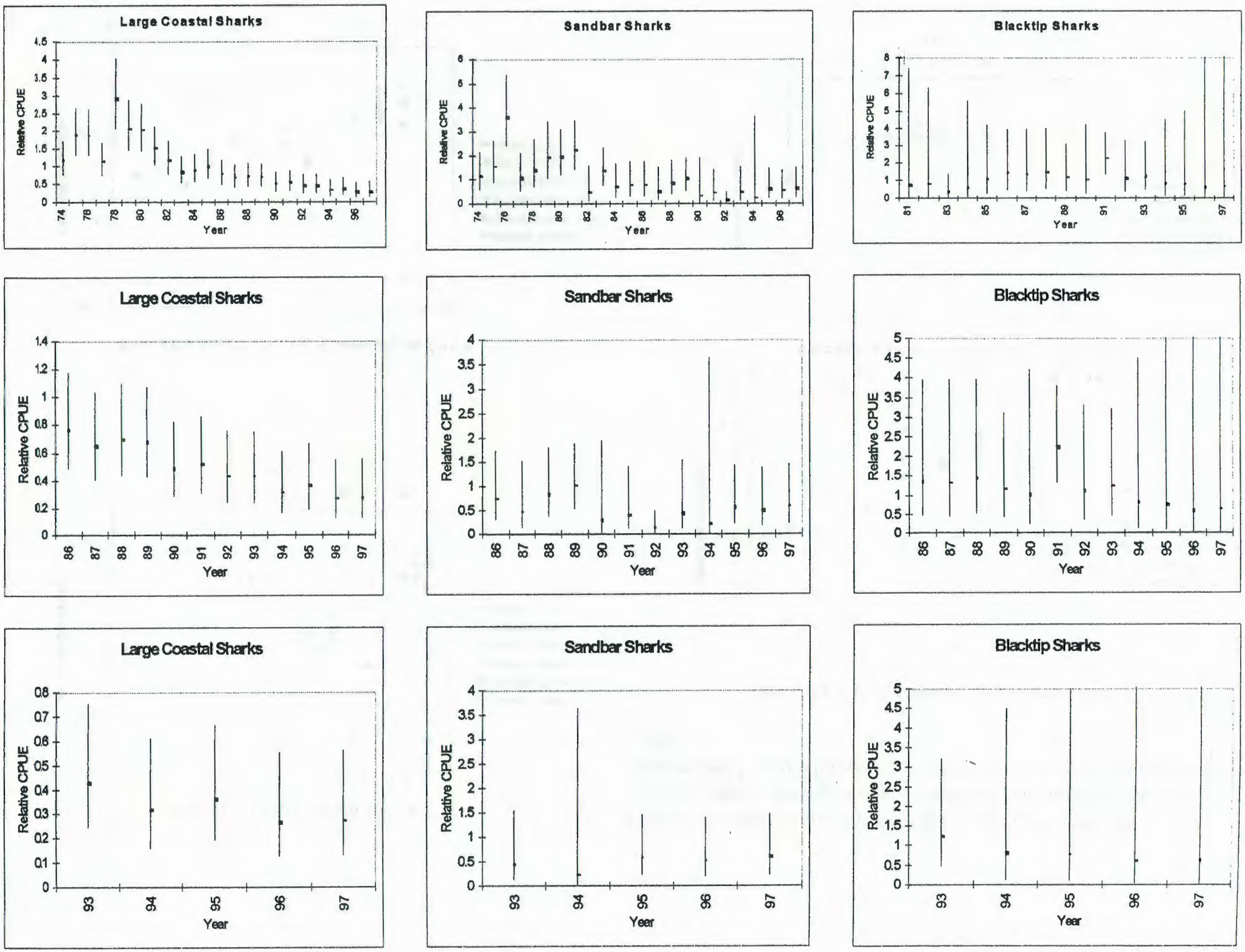


Figure 4.1. Relative catch rate patterns resulting from a Generalized Linear Model fit to the available catch-rate time series. Mean and approximate 80% confidence levels are shown.



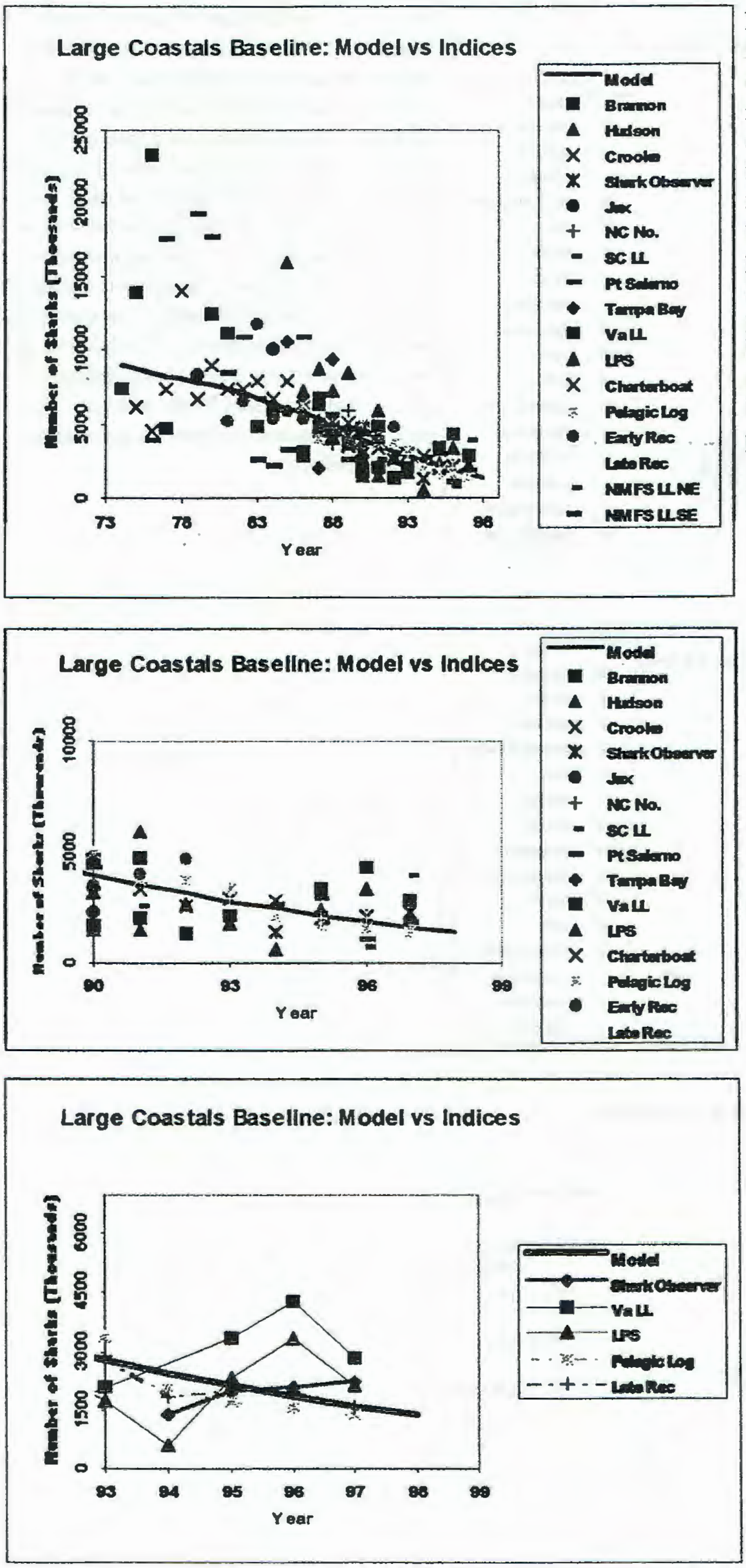


Figure 4.2. Abundance of Large Coastal Sharks predicted by the production model (expected value from Bayesian results referred to as "Model") versus the indices of abundance used in the production model fitting. The first panel presents all the data from 1974-97; the second panel plots only the 1990-97 data; in the third panel data is presented for 1993-97, plotting only those indices with 4 or more data points during that period. The model fit in this figure used the baseline catch and index data. Note, the indices of abundance are scaled by the inverse of the expected q estimated from the production model analysis.

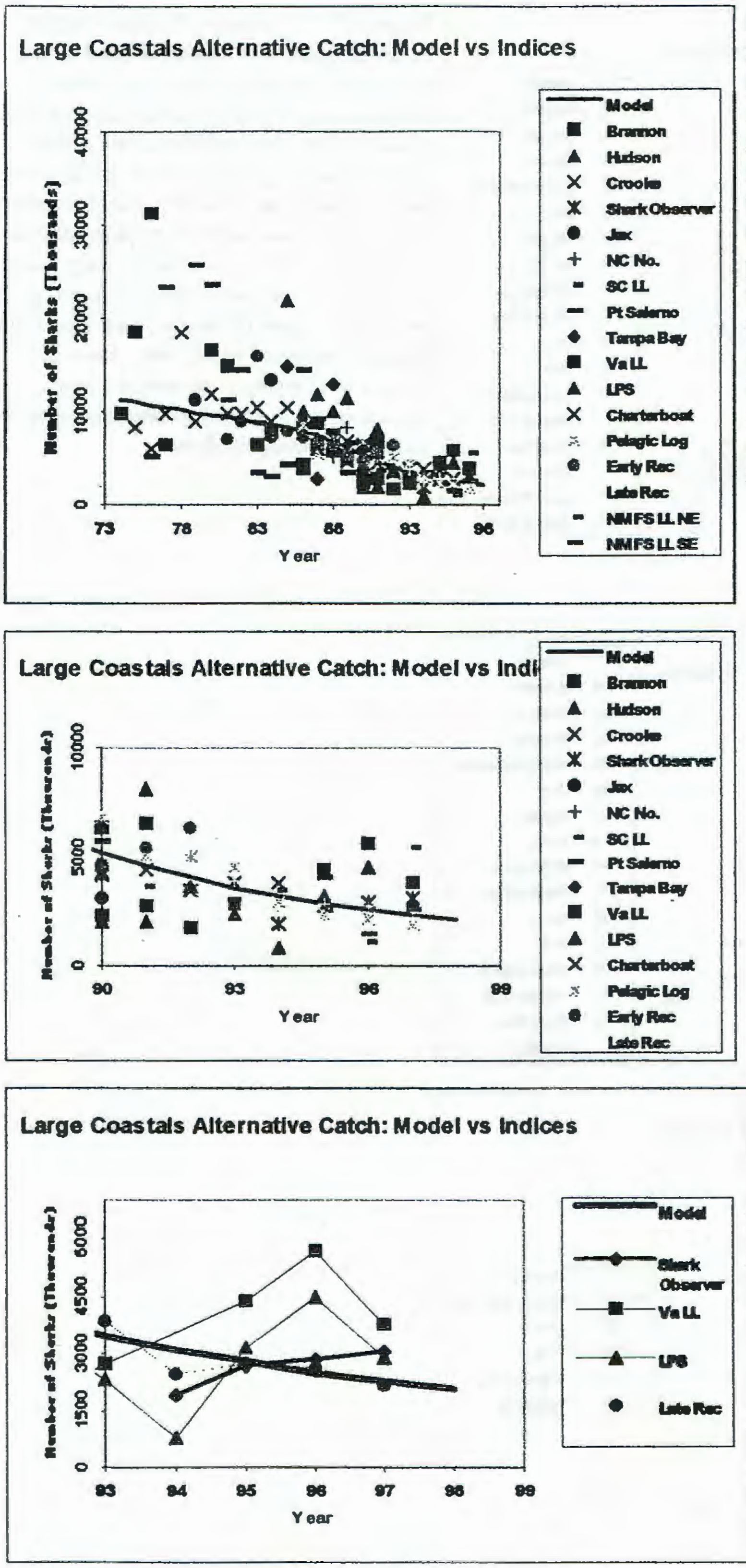


Figure 4.3. Abundance of Large Coastal Sharks predicted by the production model (expected value from Bayesian results referred to as "Model") versus the indices of abundance used in the production model fitting. The first panel presents all the data from 1974-97; the second panel plots only the 1990-97 data; in the third panel data is presented for 1993-97, plotting only those indices with 4 or more data points during that period. The model fit in this figure used the alternative catch scenario. All else is as in the baseline scenario. Note, the indices of abundance are scaled by the inverse of the expected q estimated from the production model analysis.

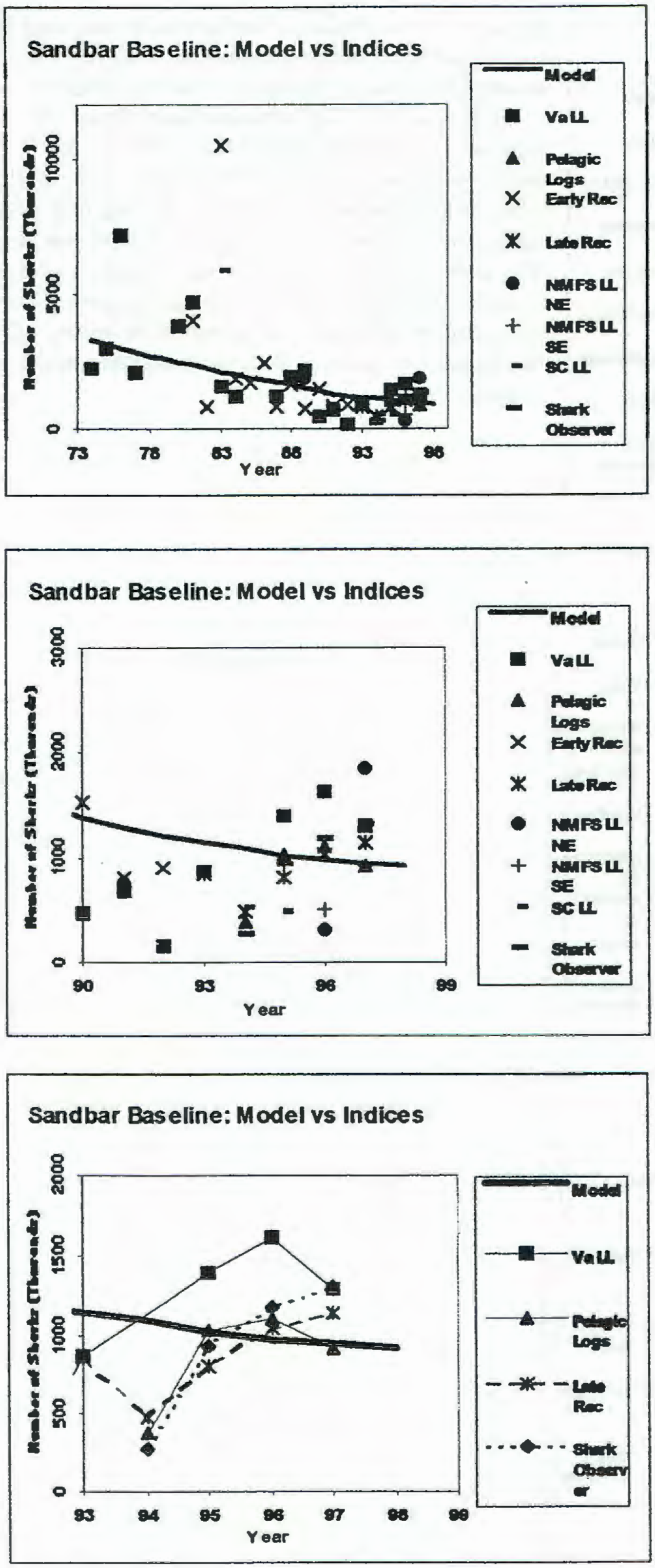
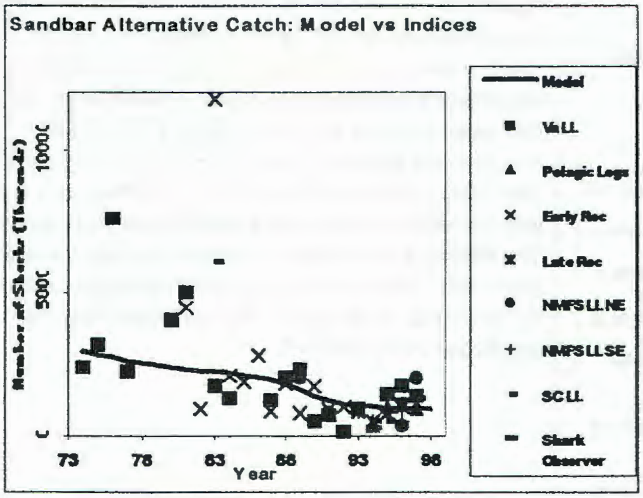
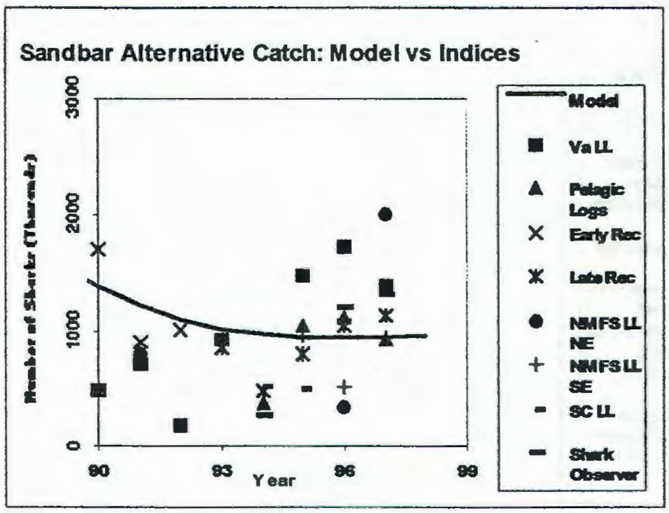


Figure 4.4. Abundance of Sandbar sharks predicted by the production model (expected value from Bayesian results referred to as "Model") versus the indices of abundance used in the production model fitting. The first panel presents all the data from 1974-97; the second panel plots only the 1990-97 data; in the third panel data is presented for 1993-97, plotting only those indices with 4 or more data points during that period. The model fit in this figure used the baseline catch and index data. Note, the indices of abundance are scaled by the inverse of the expected q estimated from the production model analysis.





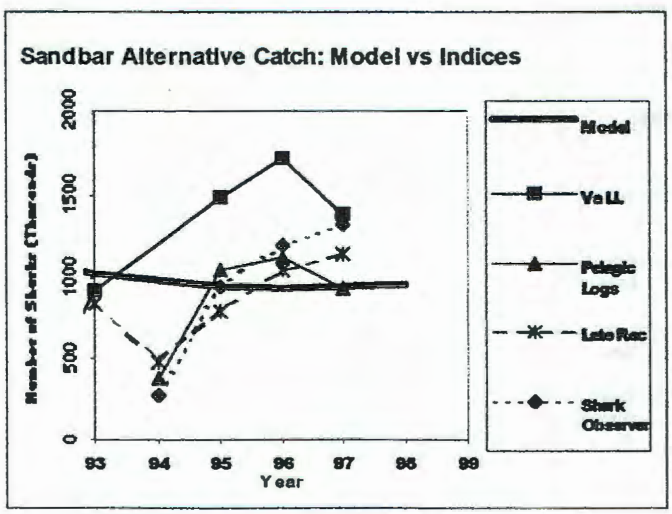


Figure 4.5. Abundance of Sandbar sharks predicted by the production model (expected value from Bayesian results referred to as "Model") versus the indices of abundance used in the production model fitting. The first panel presents all the data from 1974-97; the second panel plots only the 1990-97 data; in the third panel data is presented for 1993-97, plotting only those indices with 4 or more data points during that period. The model fit in this figure used the alternative catch scenario. All else is as in the baseline scenario. Note, the indices of abundance are scaled by the inverse of the expected q estimated from the production model analysis.

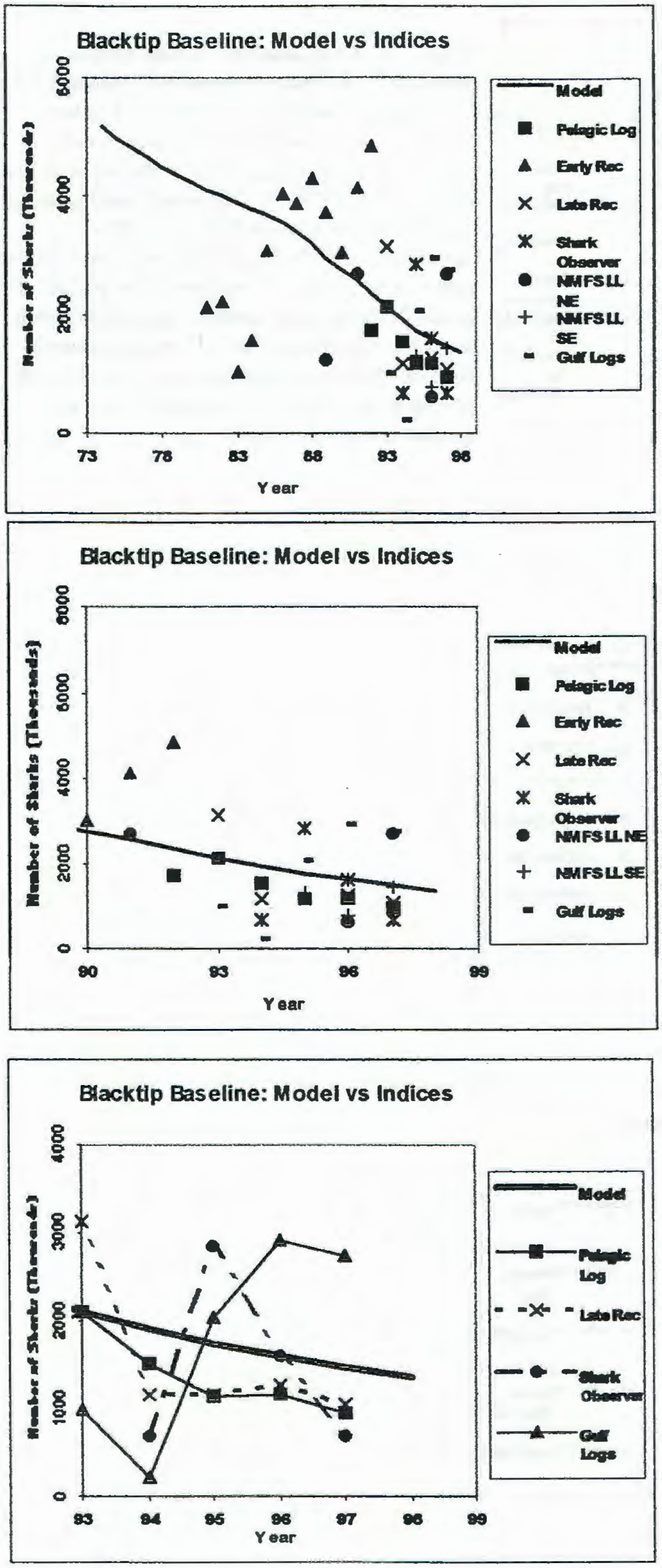


Figure 4.6. Abundance of Blacktip sharks predicted by the production model (expected value from Bayesian results referred to as "Model") versus the indices of abundance used in the production model fitting. The first panel presents all the data from 1974-97; the second panel plots only the 1990-97 data; in the third panel data is presented for 1993-97, plotting only those indices with 4 or more data points during that period. The model fit in this figure used the baseline catch and index data. Note, the indices of abundance are scaled by the inverse of the expected q estimated from the production model analysis.

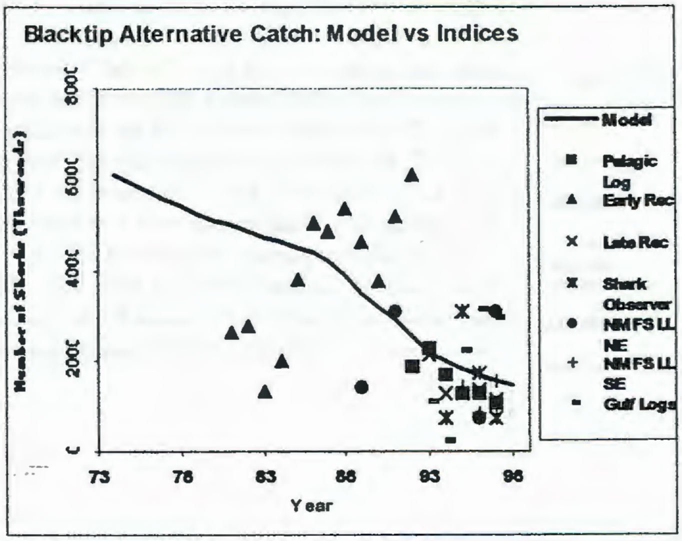
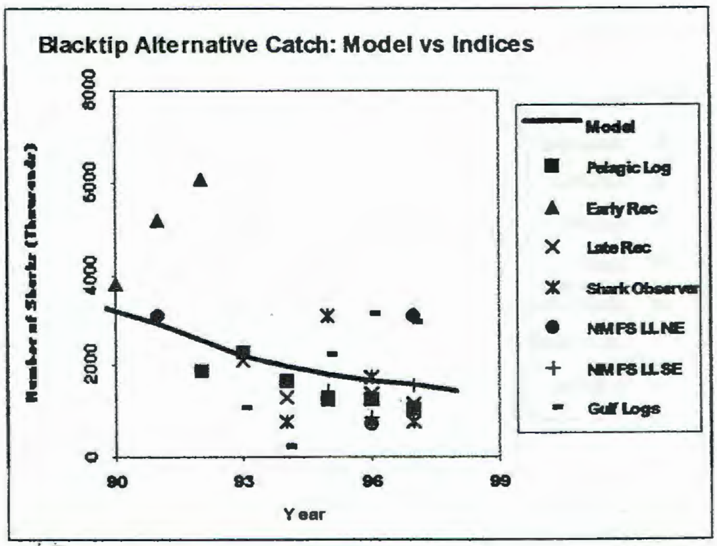
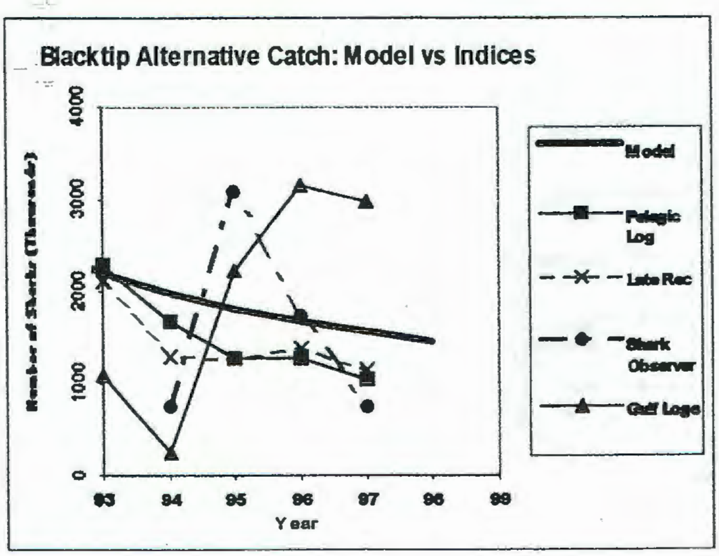


Figure 4.7. Abundance of Blacktip sharks predicted by the production model (expected value from Bayesian results referred to as "Model") versus the indices of abundance used in the production model fitting. The first panel presents all the data from 1974-97; the second panel plots only the 1990-97 data; in the third panel data is presented for 1993-97, plotting only those indices with 4 or more data points during that period. The model fit in this figure used the alternative catch scenario. All else is as in the baseline scenario. Note, the indices of abundance are scaled by the inverse of the expected q estimated from the production model analysis.





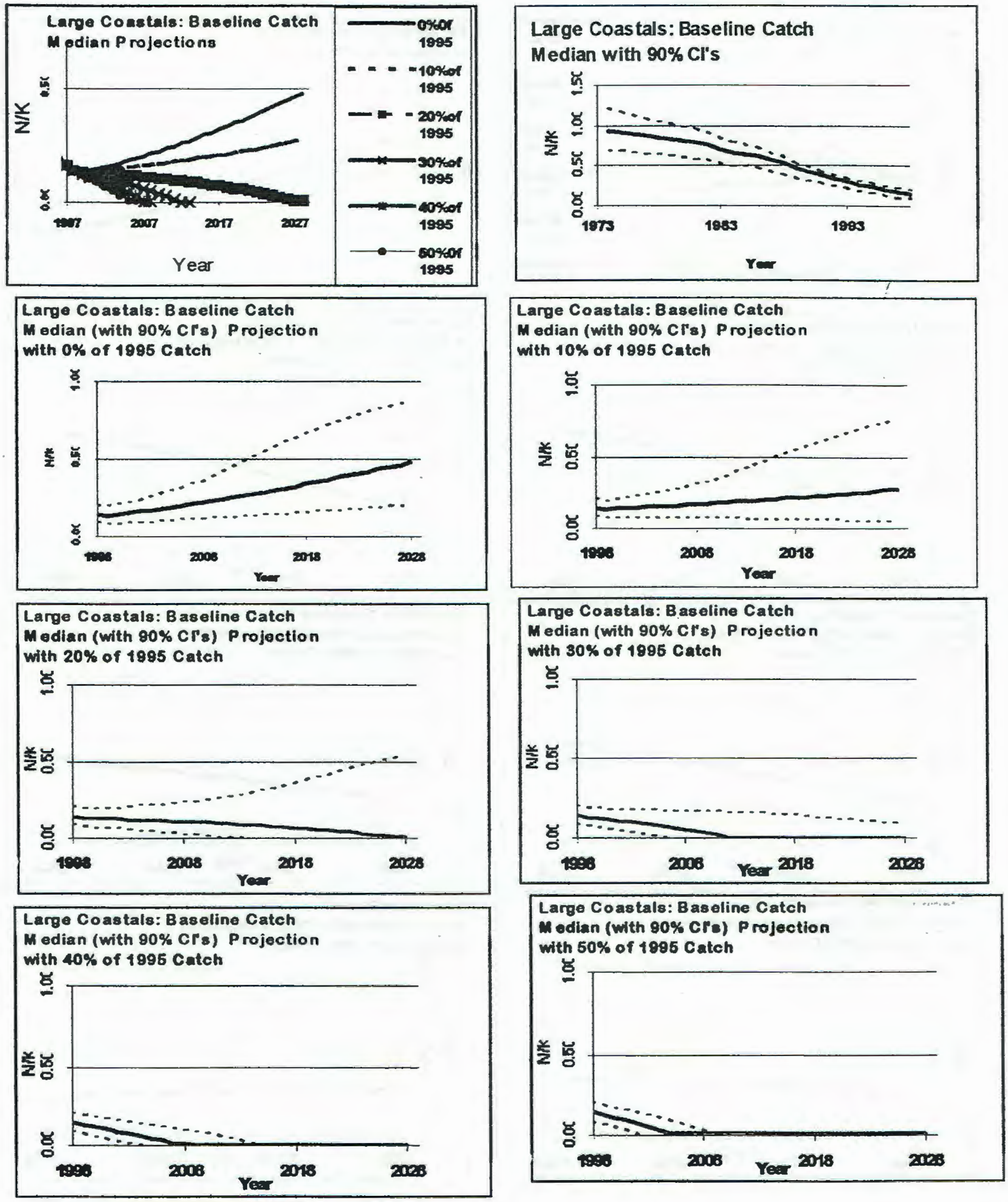


Figure 4.8. Large coastal baseline trajectories of N/K. Also, median projections (with 90% CI's) under future catch scenarios of (0, 10, 20, 30, 40 and 50% of the 1995 harvest).

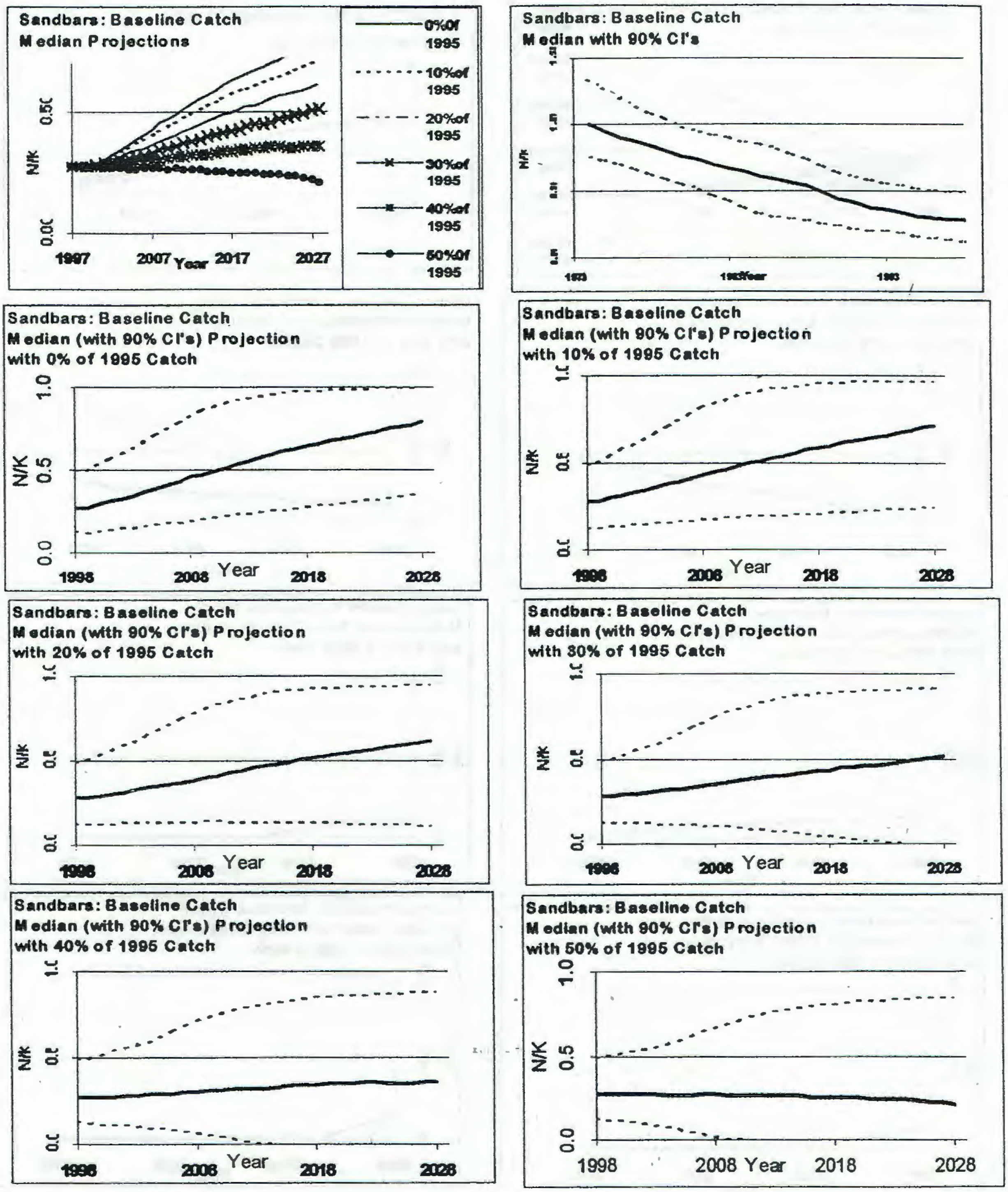


Figure 4.9. Sandbar shark baseline trajectories of N/K. Also, median projections (with 90% CI's) under future catch scenarios of (0, 10, 20, 30, 40 and 50% of the 1995 harvest).