Salton Sea Fisheries Long-term Monitoring

Draft Quarterly Report: Summer 2004

Salton Sea Program
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Introduction:

The California Department of Fish and Game (CDFG) is monitoring the status and trends of the Salton Sea fisheries. This will require a compilation of sampling results over several years. In the spring of 2003, Department personnel started quarterly sampling at fourteen stations around the sea, as the basis of a long term monitoring program. To allow comparison of current and future monitoring efforts by CDFG to past results, the following protocol was adapted from those previously used by researchers at the Salton Sea.

Each quarter, if conditions allow, this protocol will produce about 816 net-hours of sampling. After each quarter's sampling is completed this draft report will be prepared, summarizing the numbers and species of fish netted, and calculating the overall and species-based catch-per-unit-effort (CPUE). This report will also offer qualitative comments on the condition and breeding status of each species. After annual repetitions of seasonal sampling, enough data will be collected to allow statistical tests for significant differences in numbers, seasonality, and site use, by and among the four species of fish.

Methods:

The sampling sites comprise three broad habitat types: pelagic (3 sites), near-shore (8 sites), and estuarine (3 sites). The pelagic sites are in the approximate middles of the north basin, south basin and inter-basin areas of the Sea. The near-shore sites are spaced widely apart, four each, near the west and east shores, to capture as much breadth of habitat as possible. The estuarine sites are in the body of the Sea, close enough to the mouths of the New, Alamo, and Whitewater Rivers, to be under the influence of their outflows. See Table 1. for the exact locations of all sites.

Sampling takes place during each of the putative seasons, as follows: spring- April and May; summer- July and August; fall- October and November; winter- January and February. We will attempt to compress the total sampling period into as few days as possible, to the extent that the weather, equipment maintenance, and personnel scheduling constraints allow. Nets are typically set at one or two sites in the morning, and hauled in after approximately 24 hours. The exact number of hours set is recorded for each net, to the nearest quarter-hour.

Fish are sampled by deploying multi-panel monofilament gill nets with 6 X 30 foot panels of 0.5, 1, 2, 3, and 4 inch mesh. Two nets are set at all sites at the water's surface. The nets are set far enough apart to allow room for maneuvering a boat during setting and retrieval, usually 100-200 meters. The nets at near-shore and estuarine sites are set in 2.5 to 4.5 meters of water, typically 200-300 meters from the shore.

Two additional nets are set at the bottom of water column at the three pelagic sites. The conditions fish experience at the bottom in deep water is different enough from the surface water,

in dissolved oxygen, light, food availability and temperature, that this can be considered a discrete habitat, and thus we sample it as though it were a separate site.

At the time of each set and retrieval, water depth, water temperature, conductivity, salinity, and dissolved oxygen are measured and recorded.

When nets are pulled in the following day, all fish are removed and immediately stored on ice. Data are collected from these fish as soon as possible, almost always the same day they are hauled in.

All fish are identified to species level and counted. For the four sport fish in the Salton Sea, (tilapia, Gulf croaker, orangemouth corvina and sargo) weights, lengths (fork length), sex, physical condition, and reproductive status are recorded. Fish above five pounds are weighed to the nearest ounce. Fish below five pounds are weighed to the nearest half ounce. Lengths of fish under 50 centimeters are recorded to the nearest millimeter. Lengths of fish over 50 centimeters are recorded to the nearest centimeter. The sex of all adult fish is determined by dissection. A sample of at least ten fish of each species is also dissected to determine physical condition and breeding status.

Changes to Protocol for Year Two:

Our protocol is designed to elucidate long-term trends in the fisheries. Until very recently, deep water habitats have provided some low level of productivity for the fisheries, and were important habitat components to sample. Since we began sampling, however, our three deep water sites have been completely unproductive, a costly element of our efforts, and the least probable site for fish use, given the severe reduction in population size which we have discovered.

We have therefore temporarily eliminated sampling at the three deep water sites, which reduces our efforts by 288 net-hours, to a quarterly total effort of 528 net-hours. We leave these sites in the protocol, since they will likely provide useful information about population trends and habitat use, should the fisheries rebound to levels which allow robust comparisons among these and the other sampling sites.

All comparisons of CPUE that we make going forward will be among quarterly data sets that exclude previously sampled deep-water sites from the calculations. The CPUE values for our first year will then be higher overall, but the comparison between years will be valid. Our data are not designed to determine absolute numbers, but to show trends.

Results:

The Summer 2004 sampling session took place from July 6 to August 9. We sampled a total of 529 net-hours at 11 sites. Table 2. shows the totals of fishes sampled at each site. Total numbers of fishes sampled, with CPUE in parentheses, were: 2,544 tilapia (4.809), 0 Gulf croaker (.00), 0 orangemouth corvina (.00), 0 sargo (.00). Three desert pupfish were also netted, and not included in CPUE calculations.

Three size classes of tilapia were apparent. We netted 8 fish (<1%) in the largest size group, around 180-200 mm. Most tilapia (1,751 or 69%) were in a middle size class composed of fish from 120 to 160 mm long. The smallest size class was from 60 to 70 mm and comprised 31% of our catch (785 fish).

As with all tilapia we have sampled in the last year, these fish were in very good to excellent condition, and apparently not food-limited.

Discussion:

Chart 1. shows a comparison of CPUEs from this and last year's sampling sessions. The columns labeled 2002 are from an initial sampling period undertaken from June 10, 2002 through March 13, 2003. These data should be roughly comparable to later efforts, although they are not an exact replication of the sites included in our current protocol.

No Gulf croaker, orangemouth corvina, or sargo were sampled this period. There is anecdotal evidence that a single croaker and six corvina were caught by anglers this year. The most telling evidence of how depressed the marine species' populations are, is their complete absence in any fish kills observed this year.

In our last report, we called attention to the early signs of a rebound in the tilapia population. Our expectations of the scale of that rebound were apparently very conservative. Our summer CPUE for tilapia is about 3.6 times that of last summer's sampling period.

That we see three distinct size/age classes indicates that there is currently some age structure in the population, rather than a single dominant cohort. This is a positive development for the fishery, as this can provide multiple age classes of breeders, rather than a single class, which may cause the population to undergo an abrupt senescence in the future.

A couple of additional observations made during our summer sampling period are worth noting in this report: levels of piscivorous birds, desert pupfish behavior, and fish kill scale and composition.

Current levels of piscivorous birds at the Salton Sea, particularly brown pelicans, are markedly higher than in recent years. This is not in response to the increase in the tilapia population; it is a function of extremely successful breeding and fledging by this species in Baja California. Researchers at U.C. Davis have characterized this as a "banner year" for breeding brown pelicans. If the tilapia were not abundant, there would still be many brown pelicans present, but they would be starving, as rehabilitators are reporting for the recently fledged birds in the California coastal populations.

A similar caveat should be stated for understanding trends in American white pelican numbers at the Salton Sea. Most of the Salton Sea birds breed in the Klamath Basin in California and Oregon, and at Pyramid Lake in Nevada. According to U.S. Fish and Wildlife personnel at these breeding grounds, fledging success was very poor the last two years. No matter how abundant food is this year at the Sea, white pelican numbers will not rebound to the degree we are seeing in brown pelicans.

We made several observations of desert pupfish numbers and distribution, which raise questions about long-held assumptions for this species. Although only three were caught in our gill nets, this took place in waters from seven to nine feet deep, and approximately one-quarter mile from shore. We also observed many dozens of desert pupfish in fish kills, both washed up on shore, and floating in open water. In some cases, these fish were miles from the nearest drain habitat, although they were certainly susceptible to being displaced considerable distances by winds and currents.

Our observations of these pupfish may be the result of a large increase in their numbers, and/or they may represent an expansion of pupfish into previously underutilized habitats.* In any case, this is taking place within the context of an explosive increase in tilapia numbers. The idea that increases in exotic fishes in desert pupfish habitat, particularly tilapia, are responsible for their decline over the last two decades, must be re-examined. Pupfish appearance in deeper water than previously thought likely, raises the possibility that their occupation of the Salton Sea proper was being suppressed by the (now almost absent) marine species.

The fish kills which occurred during the summer sampling period were remarkable not for their scale, location, or timing, but for their composition. They contained none of the three marine species, and were comprised solely of tilapia, sailfin mollies, striped mullet, and desert pupfish. The mollies and pupfish are expected components of any fish kill which originates close to shore, but in the past they have not been so obviously visible in fish kills. We infer an increase in their numbers in the Sea, from this increased presence in the fish kills.

We have taken a few striped mullet in our nets over the last two years, and made multiple observations of small schools of adults, around the deltas of the New and Alamo Rivers. Several mullet also turned up in the most recent fish kill, along the south end of the Sea, bracketing the Alamo River. The last significant involvement of striped mullet in a fish kill event was on August 5, 2001, when approximately 1,800 adults were killed, again centered at the Alamo River delta.

* These observations are not likely the result of uneven levels of effort or expertise. For the last three years, the same Department personnel have conducted visual examinations of fish kills at the Salton Sea, to control observer error.

Table 1. Locations of Sampling Sites

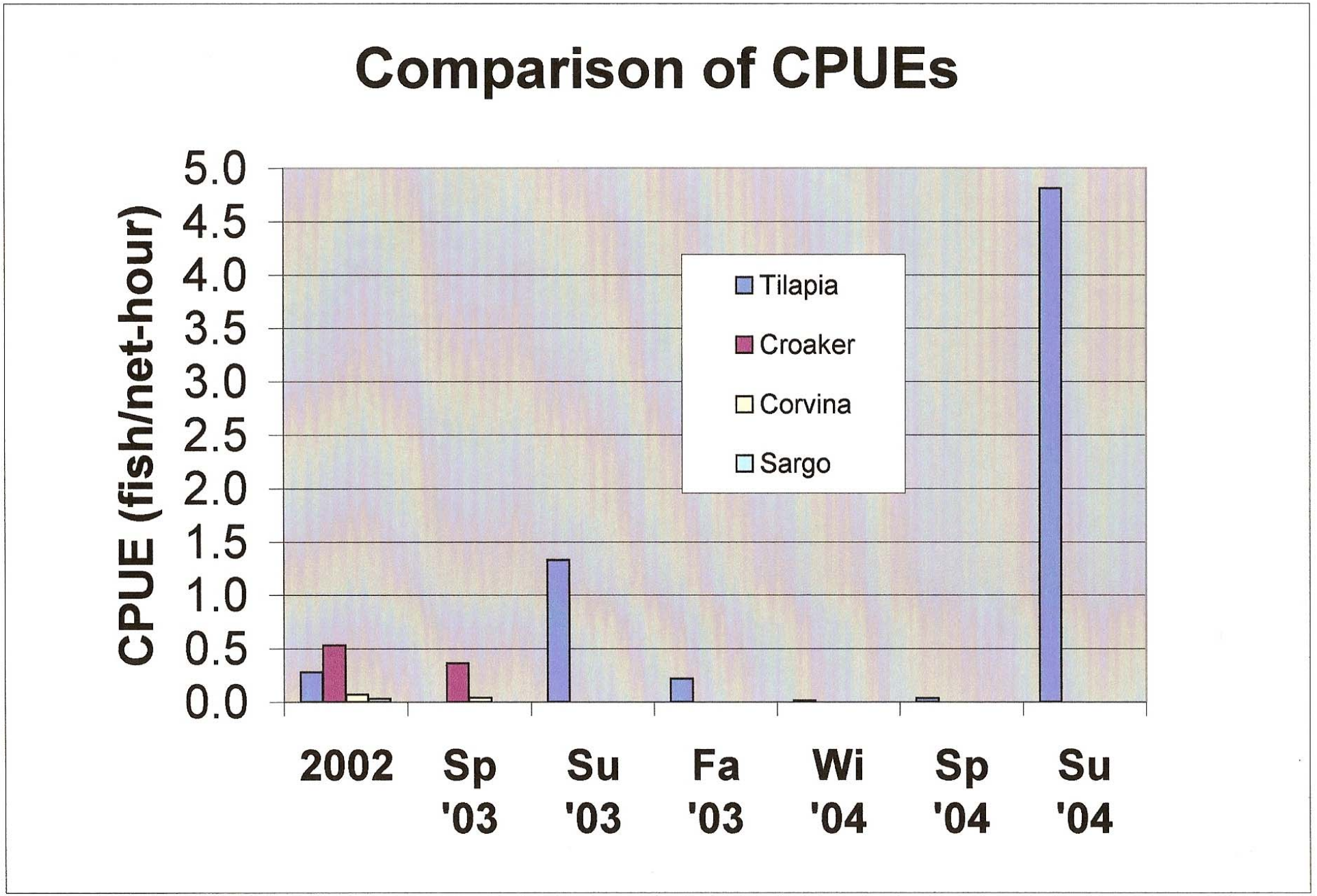
SITE NAME	HABITAT TYPE	UTM COORDINATES
Whitewater River	Estuarine	11S 0587948
		3707343
New River	Estuarine	11S 0621567
		3666958
Alamo River	Estuarine	11S 0628480
		3675635
North Shore	Near-shore	11S 0598465
		3709237
North Wister	Near-shore	11S 0628368
		3685497
Bat Caves	Near-shore	11S 0607427
		3699864
South Salton City	Near-shore	11S 0604971
		3682198
North Desert Shores	Near-shore	11S 0589366
		3699424
The Dome	Near-shore	11S 0596997
		3690022
The Cliffs	Near-shore	11S 0615062
		3691509
Test Base	Near-shore	11S 008813
		3672196
North Basin	Pelagic	11S 0596156
		3701218
Inter-basin	Pelagic	11S 0606837
		3689452
South Basin	Pelagic	11S 0618275
		3678697

Table 2.

Date	Site	Net-hours	Tilapia	Croaker	Corvina	Sargo	Other	Total Fish	CPUE
7/6/2004	Alamo River	46	13	0	0	0	0	13	0.28
7/6/2004	North Wister	47	37	0	0	0	1	38	0.80
7/6/2004	New River	47	14	0	0	0	0	14	0.30
7/8/2004	The Cliffs	49	102	0	0	0	2	104	2.08
7/8/2004	Bat Caves	50	201	0	0	0	0	201	4.02
7/13/2004	White Water River	49	332	0	0	0	0	332	6.85
7/13/2004	North Shore	51	448	0	0	0	0	448	8.83
8/3/2004	North Desert Shores	47	10	0	0	0	0	10	0.21
8/3/2004	The Dome	48	239	0	0	0	0	239	5.03
8/9/2004	Test Base	48	1096	0	0	0	0	1096	23.07
8/9/2004	South Salton City	50	52	0	0	0	0	52	1.04
Totals		**529**	**2544**	**0**	**0**	**0**	**3**	**2547**	**4.809**

one pupfish @North Wister
two pupfish @ the Cliffs

Chart 1.


Comparison of CPUEs
CPUE (fish/net-hour)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Tilapia
Croaker
Corvina
Sargo
2002
Sp '03
Su '03
Fa '03
Wi '04
Sp '04
Su '04