

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE RECOMMENDATIONS
FOR WINTER-RUN CONSERVATION MEASURES IN 2017 OCEAN FISHERIES

CDFW's policy recommendation for 2017 ocean salmon fisheries is that sport fisheries in Monterey-north (Pigeon Point to Point Sur) be closed starting July 16th, closed in Monterey-south (Point Sur to U.S. Mexico Border) starting June 1st, and that the sport fishery in San Francisco (Point Arena to Pigeon Point) be closed in November. For commercial fisheries, CDFW recommends a closure date for Monterey-north beginning August 1st and a closure date for Monterey-south beginning July 1st. These 2017 recommendations mirror CDFW's recommendations from 2016.

Introduction

Drought conditions in California led to greater than 95 percent mortality of juvenile brood year 2014 and 2015 Sacramento River winter Chinook (winter-run) prior to downstream emigration due to unusually low water storage in Lake Shasta and unsuitable water temperatures in the upper Sacramento River. As a result, juvenile brood year 2015 winter-run passage at Red Bluff Diversion Dam has been estimated to be the lowest on record, with brood year 2014 being the third lowest (see Agenda Item E.4.b., Supplemental CDFW Report, March 2016 Pacific Fishery Management Council [Council] Meeting). These catastrophic brood failures have been the impetus for additional protective measures in California's ocean and inland salmon fisheries over the course of the last two years.

Winter-run escapement for 2016 was estimated at 1,546 fish, which is the second lowest total on record since carcass surveys for winter-run began in 2001. Since most of the fish returning in 2016 were from brood year 2013, which experienced relatively normal juvenile production and survival during emigration (see Agenda Item F.1.d., Supplemental STT Report, March 2015 Council Meeting), this low escapement may be indicative of poor ocean conditions. Similar conditions may also have affected brood years 2014 and 2015 (see Agenda Item D.1.a., NMFS Report 1, State of the California Current Report, March 2016 Council Meeting).

In April 2015 and 2016, the Council adopted CDFW recommendations for additional constraints in ocean sport and commercial fisheries beyond those required under the harvest control rule (see Agenda Items D.1.e., Supplemental CDFW Report 4, April 2015 Council Meeting and E.1.e., Supplemental CDFW Report, April 2016 Council Meeting). These constraints were specifically designed to minimize contacts with brood year 2014 and 2015 winter-run and to provide conservation benefit to the winter-run stock as a whole. The Council has recognized that the current harvest control rule used for winter-run management is not adequately responsive to precipitous declines in stock abundance, as it is based exclusively on escapement of brood years that have already been subject to the fishery.

While a new harvest control rule is currently being developed that will utilize forecasted abundance of winter-run prior to fisheries, it will not be ready for use in 2017 ocean fishery management (see Agenda Item D.2.a., Supplemental STT Report, November 2016 Council Meeting). In 2017, brood year 2015 and 2014 winter-run will be fully vulnerable to ocean fishery harvest as age-3 and age-4 fish, respectively, while brood year 2016 fish may be contacted as sub-legals. In the absence of a pre-fishery winter-run ocean abundance forecast and in response to facts suggesting these three broods have fared poorly to date (see Agenda Item E.2.a., Supplemental CDFW Report, March 2017 Council Meeting), coupled with persistent drought conditions and unusually warm ocean conditions, CDFW again recommends the Council consider additional safeguards in 2017 beyond those required by the ESA biological opinion and current harvest control rule in order to further minimize the risk of impacting winter-run in ocean fisheries.

Analysis of Historical Harvest

Data summaries provided by CDFW in the aforementioned supplemental report from the April 2016 Council Meeting showed that winter-run are primarily contacted south of Point Arena. Of the 632 winter-run CWTs collected in California fisheries since Livingston Stone National Fish Hatchery began production in 1998, approximately 98 percent of these were taken in the San Francisco and Monterey port areas (**Table 1**). The available CWT data also suggests that these fish tend to be more susceptible to contact or harvest in ocean fisheries during mid to late summer and early fall, especially south of Pigeon Point. CDFW also reviewed Genetic Stock Identification (GSI) data collected during non-retention sampling by California commercial salmon trollers in 2010, as well as during retention sampling from 2011 through 2015. Similarly, that evaluation suggested that winter-run are concentrated south of Pigeon Point in the late summer, and even more so south of Point Sur.

To determine where and when risks of winter-run interactions are highest compared to expected catch of more abundant target stocks, CDFW staff examined the ratio of winter-run to all other stocks in the hatchery component of the commercial and sport harvest south of Point Arena during the last fifteen open seasons (2000-2007, 2010-2016) based on over 103,000 CWT recoveries (**Table 2**). In addition to being summed by year, month, and fishery, CWTs were grouped into four sub-port areas based on port of landing:

Bodega Bay (Pt. Arena to Pt. Reyes)

San Francisco (Pt. Reyes to Pigeon Pt.)

Monterey Bay (Pigeon Pt. to Pt. Sur; “Monterey-north” during 2016 salmon season)

Morro Bay-Avila (Pt. Sur to U.S.-Mexico border; “Monterey-south” during 2016 salmon season)

All CWTs were expanded by their respective sampling and hatchery-tagging rates to estimate the hatchery-origin component of the Chinook catch by month, sub-area, and fishery. Tags are expanded for sampling and tag rates for the purpose of understanding total catch of hatchery stocks by run type. The bulk of hatchery harvest is comprised of Sacramento River fall Chinook,

which are only tagged at a rate of 25 percent, whereas winter-run are tagged at a rate of 100 percent. By expanding the tag recoveries appropriately, an approximation of the winter-run contribution to total catch is possible as opposed to simply looking at winter-run contribution to raw tag recoveries. The 36,457 CWTs collected in the sport fishery represented just under 343,000 hatchery-origin salmon landed, while the 66,942 CWTs recovered in the commercial fishery expanded to more than 691,000 hatchery fish. CWT recoveries were grouped as either winter-run (winter) or “other” stocks to determine their average annual harvest by fishery, month and sub-port area.

Figure 1 shows the average annual hatchery harvest and ratio of winter-run salmon to other stocks in the sport fishery by sub-port area and month. The ratio of winter-run harvest to other stocks (shown above each bar on each of the bar charts) was highest toward the end of summer-early fall and in the southern areas. This is the same pattern noted in the CDFW Supplemental Report from the April 2016 Council meeting cited above.

Bodega Bay had the lowest total ratio of winter-run harvest to other stocks at 1:900 (53 winter, 48,786 other). Ratios ranged from 1:1200 in June to 1:600 during July. There were no winter-run hatchery fish encountered during April, May, September, October, or November. Average monthly harvest peaked in July with approximately 1,700 hatchery salmon caught, followed by June (500 fish) and August (400 fish).

The total ratio in San Francisco was higher at 1:200 (772 winter, 182,702 other) with monthly ratios ranging from 1:1600 during September to 1:60 during November. Average monthly hatchery harvest peaked in July with 3,000 hatchery salmon landed, followed by August (2,500), June (1,800), and May (1,800).

In Monterey Bay, the total harvest ratio of 1:140 (739 winter, 102,721 other) was slightly higher than the ratio observed in San Francisco. Ratios ranged from 1:900 during April to 1:30 during August. Average monthly harvest was highest in April with 3,900 hatchery salmon caught (highest monthly average among all sub-port areas), but dropped sharply in May (900 fish) and June (600 fish). Landings increased during July (1,200 fish) but again decreased during August and September. Although sampling of the sport fishery south of Pigeon Point did occur throughout the entire season, relatively few CWTs were collected during the last two months (September and October), due to minimal fishing activity.

Morro Bay-Avila had the highest total harvest ratio of 1:19 (374 winter, 6,767 other) among the four sub-port areas, ranging from 1:60 in April to 1:1 in August. Average monthly hatchery harvest was highest in April (200 fish), followed by May (130 fish) and June (100 fish). Only a handful of hatchery fish were landed in July, August, and September.

In addition to evaluating the ratio of winter-run harvest to that of other target stocks, CDFW examined the proportion of winter-run CWTs to all CWT recoveries (expanded) in the sport fishery by month and sub-port area during the same fifteen year period (**Figure 2**). The total proportion of winter-run in Morro Bay-Avila (5.2 percent) was much higher than that observed

north in Monterey Bay (0.7 percent), San Francisco (0.4 percent), and Bodega Bay (0.1 percent). The Morro Bay-Avila sport fishery also had the highest proportion of winter-run CWT recoveries observed during April through August in all areas. The proportion of winter-run CWTs increased sharply from April (1.7 percent) through August (64.1 percent).

Figure 3 shows the average annual hatchery harvest and ratio of winter-run salmon to other stocks in the commercial fishery by sub-port area and month. The ratio of winter-run harvest to other stocks was generally highest toward the end of summer and early fall and increased the further south that fishing occurred.

Bodega Bay had the lowest total winter-run harvest to other stocks ratio of 1:3700 (56 winter, 206,524 other). Ratios ranged from 1:6600 during July to 1:1800 during September. Average monthly harvest peaked in July with approximately 5,700 hatchery salmon caught, after averaging 4,000 salmon in May and 3,900 in June. Average hatchery catch declined to 2,500 and 900 in August and September, respectively.

The total ratio in San Francisco was slightly higher at 1:2200 (130 winter, 291,488 other) with ratios ranging from 1:31700 during May to 1:1300 during June. Average monthly harvest was highest in May and June with 7,900 and 7,000 hatchery salmon caught, respectively. The hatchery harvest in July dropped to approximately 3,800 fish with landings steadily declining to the end of the season in October.

In Monterey Bay, the total harvest ratio of 1:1200 (140 winter, 171,332 other) was approximately two and three times greater than the ratios observed in San Francisco and Bodega Bay, respectively. Ratios ranged from 1:4900 during May to 1:7 during September. Average monthly harvest was highest in May with 6,300 hatchery salmon landed, followed by June (3,900 fish) and July (2,700 fish). The average hatchery harvest in August and September dropped sharply to approximately 200 and 5 fish, respectively; however there are very low sample sizes south of Pigeon Point after about mid-August, in response to very low catch and effort levels. Thus there are relatively few CWTs collected during the last two months of the season.

Morro Bay-Avila had the highest total harvest ratio of 1:200 (104 winter, 21,909 other) among commercial fisheries in the four sub-port areas, ranging from 1:1000 in May to 1:8 in September. Average monthly hatchery harvest was highest in May with 900 fish, followed by June (700 fish). The average hatchery harvest in July dropped sharply to 100 fish and less than 50 fish landed in August. Only a handful of fish were landed in September.

Figure 4 shows the proportion of winter-run CWTs to all CWT recoveries (expanded) in the commercial fishery by month and sub-port area during the same fifteen year period. The total proportion of winter-run in Morro Bay-Avila (0.5 percent) was much higher than that observed north in Monterey Bay (0.08 percent), San Francisco (0.04 percent), and Bodega Bay (0.03 percent). The highest proportion of winter-run CWT recoveries occurred in Monterey Bay (12.2

percent) and Morro Bay-Avila (11.1 percent) during September. Winter-run proportions in Morro Bay-Avila increased ten-fold between July (0.7 percent) and August (7.7 percent).

Figure 5 shows the location of GSI samples from winter-run (n=55) versus all other stocks (n=31,455) collected by California salmon trollers during 2010-2015 statewide. This includes approximately 4,500 aged samples from the 2010 non-retention study that CDFW analyzed last year (see Agenda Item D.1.e., Supplemental CDFW Reports 2 and 3, April 2015 Council Meeting), in addition to 26,510 samples collected opportunistically in open fisheries during 2011-2015. Almost 91 percent (n=50) of the winter-run samples were collected south of Pt. Arena, with two-thirds (n=33) of these samples collected south of Pigeon Point and almost half (n=23) sampled south of Pt. Sur. By comparison, the number of other stocks sampled south of Pt. Sur over this six-year time period in the GSI study was only 94 of the 31,455 sampled statewide, or 0.2 percent of the total.

Figure 6 shows the proportion of winter-run GSI samples (n=50) to all GSI samples (n=17,607) collected south of Pt. Arena by month and sub-port area. Similar to the CWT results above, the proportion of winter-run was highest in late summer south of Pigeon Point, especially in the Morro Bay-Avila port area during September (61.1 percent), August (60.0 percent), and July (13.3 percent). Winter-run samples were not recovered in Monterey Bay until July (0.2 percent) and then increased dramatically during August (2.3 percent) and September (5.4 percent). Winter-run proportions in San Francisco and Bodega Bay were relatively small, averaging 0.2 percent and 0.04 percent, respectively.

2015 and 2016 Harvest Results

During the 2015 season, there were no winter-run CWTs recovered south of Pigeon Pt. and only two recovered between Pt. Arena and Pigeon Pt. This suggests that the additional fishery closures recommended by the Council may have helped protect winter-run since fisheries in these areas averaged 26 and 11 winter-run CWT recoveries, respectively, during the previous four seasons. However, minimal recoveries may also reflect low ocean abundance of the winter-run broods that were vulnerable to harvest in 2015 fisheries (brood years 2013 and 2012).

In 2016, there were 2 winter-run CWTs recovered south of Pigeon Pt. and 13 recovered between Pt. Arena and Pigeon Pt. While this represents an increase over 2015, particularly for areas north of Pigeon Pt., all but one of the recoveries last year were from brood year 2014. This was the year Livingston Stone National Fish Hatchery tripled hatchery production of winter-run in response to the first catastrophic in-river brood failure.

Conclusions from this Analysis

Figures 1 and 2 of this report show that winter-run harvest rates in the sport fishery increase significantly as the summer progresses to fall, and also increase significantly moving southward, with the highest rates observed in the Morro Bay-Avila area – an area where overall sport

catches are low compared with other areas of the state. As depicted in Figure 1, the vast majority of the total hatchery harvest in Monterey Bay sport fisheries occurs before August, making fishing opportunities in this area during April through July particularly important compared to the management areas to the north, which maintain appreciable harvests later into summer and fall.

As shown in Figure 3, the commercial fishery sees over 98 percent of the total hatchery harvest in Monterey Bay before August. In this area, greater value lies in these first three months as compared to the management areas to the north. Meanwhile, the Morro Bay-Avila area sees the bulk of their catch and fishery value in the first two months.

Harvest of winter-run in commercial fisheries is much less severe as compared to sport fishery harvest due to larger size limits. Figures 3 and 4 suggest that winter-run tend to become a more significant part of the commercial harvest beginning in August in Monterey Bay and July in Morro Bay-Avila. In both areas, August and September are high risk fisheries for winter-run harvest.

Analysis of available CWT and GSI data across both sport and commercial fisheries suggest that not only do the ratios of winter-run increase significantly south of Pigeon Pt. in the summer and in the San Francisco sport fishery during November, the catch of other target stocks declines precipitously as well (Figures 1 and 3). All data sources show high proportions of winter-run in catches in Morro Bay-Avila from June or July onward. While Monterey-north sport and commercial fisheries in July show an increased proportion of winter-run in CWT recoveries compared with earlier months (Figures 1-4), that same increase is not detected in the July GSI data, though it shows a dramatic increase in winter-run catch rates come August (Figure 6). Since July is a month that also experiences relatively high average catches of other target stocks in Monterey-north (Figures 1 and 3), clearly fishing opportunities in that month are very important to the region and local economies.

CDFW appreciates the critical need to evaluate the social and economic interests along with the potential risk to the winter-run stock that comes with fisheries operating in these areas. In developing policy guidance for crafting 2017 ocean salmon fisheries, CDFW has considered both the value of time/area opportunities to each of the sport and commercial sectors independently, based on the average annual hatchery harvest information, in addition to considering the risks associated with those fisheries to the winter-run stock. CDFW's recommendations were finalized only after carefully balancing the risks posed from high winter-run catch ratios against the value of fishery opportunities to regional economies and the value of those opportunities statewide.

Sport fisheries generally rely on open days and opportunities more so than realized catch. Party/charter operations are not likely able or willing to follow fish, like some commercial and private recreational vessels may do to pursue open fishing opportunities beyond their home port. Meanwhile, some commercial fish buyers may operate only locally, or may have buying arrangements dependent on delivery only to certain ports.

Winter-run harvest rates in the Morro Bay-Avila sport fishery show that the likelihood of catching a winter-run in April is 1:60, increasing to 1:1 in August – catch rates which pose serious concern when considering recommendations to authorize fisheries. However, CDFW recognizes that there is an overriding statewide interest in providing some opportunity to each sector at some point during the season in every management area, and further recognizes that the needs of sport and commercial fisheries and the communities reliant upon them differ. It would not be equitable to apply a hardline cutoff point where, as an example, risk would be deemed ‘too high’ any time the chance of harvesting a winter-run is greater than one fish in a hundred because of these diverse needs, and because management tools such as size limits can have a significant effect on the ratio information evaluated here. Consistent with the approach taken for 2016 fisheries, CDFW’s recommendations are based on evaluating the relative risk to winter-run combined with the value of fishery opportunity in a given month, compared to other months in that fishery and area. CDFW looks forward to working collaboratively with Council and fishery representatives, National Marine Fisheries Service, and other interested parties in developing and finalizing 2017 ocean salmon fishery regulations.

CDFW would like to acknowledge and thank the California contingent of the West Coast GSI Collaboration for assisting with data requests.

Table 1. Winter-run CWT releases and ocean recoveries by major port area, brood years 1998-2014.

Brood year	CWT marked and tagged	KMZ	Fort Bragg	Major port area			Total Ocean recoveries
				San Francisco	Monterey Bay	Pt Sur south	
1998	147,007	1	0	9	23	4	37
1999	30,367	0	2	11	5	2	20
2000	162,198	0	0	12	10	2	24
2001	242,383	0	0	9	2	1	12
2002	221,334	1	2	136	69	18	226
2003	216,676	0	1	61	22	49	133
2004	143,280	0	0	3	1	0	4
2005	163,935	0	0	1	2	2	5
2006	181,681	0	0	0	0	0	0
2007	69,066	0	1	0	0	0	1
2008	133,520	0	0	1	0	1	2
2009	183,644	0	3	15	36	17	71
2010	113,905	0	1	4	2	8	15
2011	185,313	0	0	9	24	1	34
2012	169,967	0	2	17	8	5	32
2013	190,905	0	0	1	0	1	2
2014	590,623	<u>0</u>	<u>0</u>	<u>13</u>	<u>0</u>	<u>1</u>	<u>14</u>
		2	12	302	204	112	632
		0.3%	2%	48%	32%	18%	

Table 2. Total raw CWT recoveries by fishery, year and sub-port area, 2000-2016.*

Year	<u>Ocean Salmon Sport Fishery CWT recoveries</u>				Total
	Bodega Bay	San Francisco	Monterey Bay	Morro Bay-Avila	CWTs
2000	148	589	632	23	1,392
2001	200	758	391	5	1,354
2002	294	1,202	619	59	2,174
2003	256	1,318	314	2	1,890
2004	259	2,167	815	48	3,289
2005	189	1,148	331	67	1,735
2006	260	529	105	6	900
2007	86	378	98	3	565
2010	196	259	337	3	795
2011	445	2,192	1,013	26	3,676
2012	893	3,290	1,828	139	6,150
2013	622	2,608	530	45	3,805
2014	492	2,401	1,044	57	3,994
2015	278	2,048	231	27	2,584
2016	<u>404</u>	<u>1,703</u>	<u>42</u>	<u>5</u>	<u>2,154</u>
Total	5,022	22,590	8,330	515	36,457

Year	<u>Ocean Salmon Commercial Fishery CWT recoveries</u>				Total
	Bodega Bay	San Francisco	Monterey Bay	Morro Bay-Avila	CWTs
2000	304	1,088	1,458	277	3,127
2001	886	1,350	664	69	2,969
2002	836	2,147	999	36	4,018
2003	2,076	1,695	807	0	4,578
2004	1,299	3,571	1,516	71	6,457
2005	597	776	1,376	185	2,934
2006	382	103	142	2	629
2007	633	427	78	0	1,138
2010	43	25	153	0	221
2011	934	664	462	70	2,130
2012	5,047	4,052	4,161	960	14,220
2013	3,633	4,895	1,813	206	10,547
2014	3,277	3,151	766	33	7,227
2015	1,190	1,413	1,537	295	4,435
2016	<u>539</u>	<u>1,023</u>	<u>609</u>	<u>141</u>	<u>2,312</u>
Total	21,676	26,380	16,541	2,345	66,942

TOTAL 103,399

* California sport and commercial ocean fisheries closed or heavily constrained during 2008 and 2009.

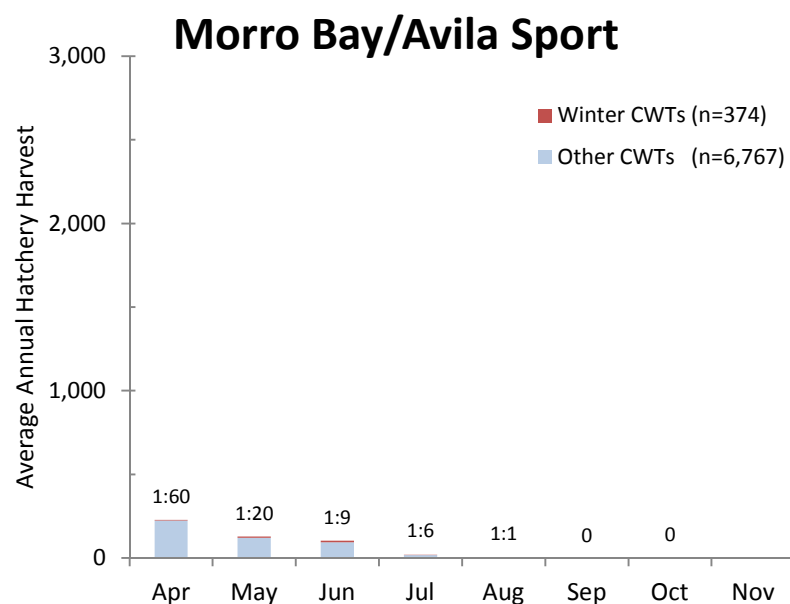
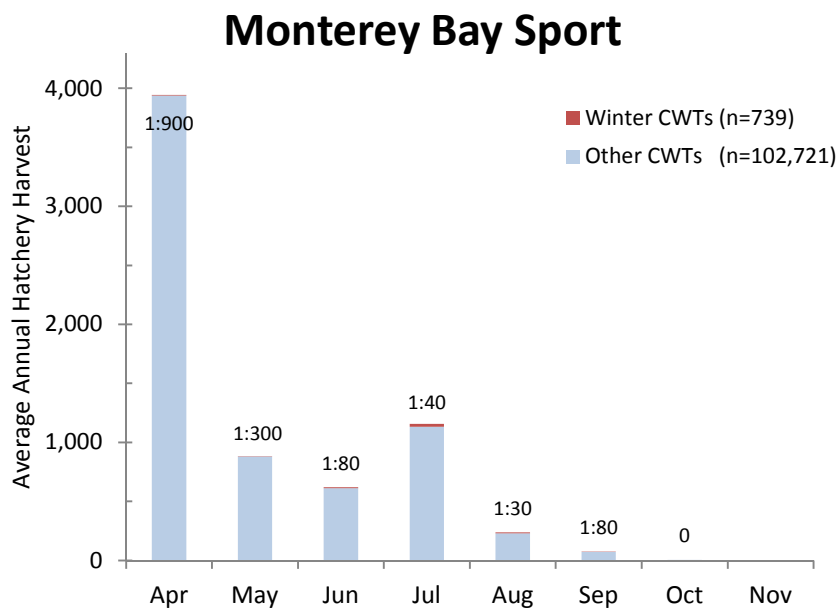
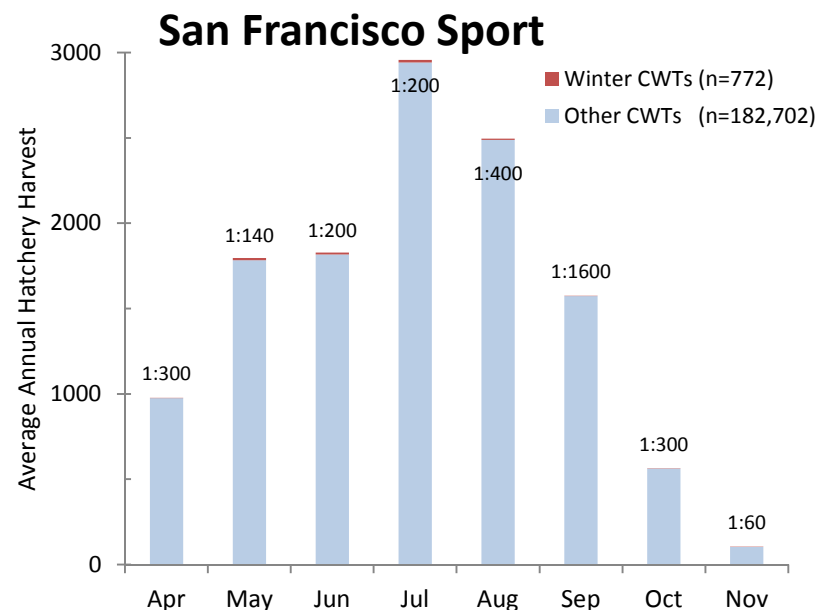
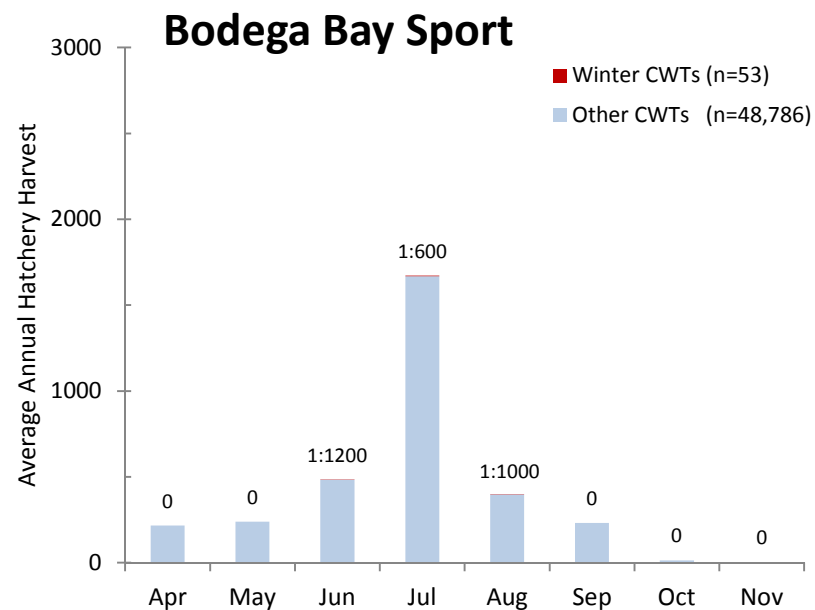


Figure 1. Average annual harvest of hatchery-origin winter-run (Winter) versus all other stocks (Other) in the ocean salmon sport fishery south of Point Arena based on expanded CWT recoveries by sub-port area and month, 2000-2016. Ratio of Winter harvest to Other harvest above each bar.

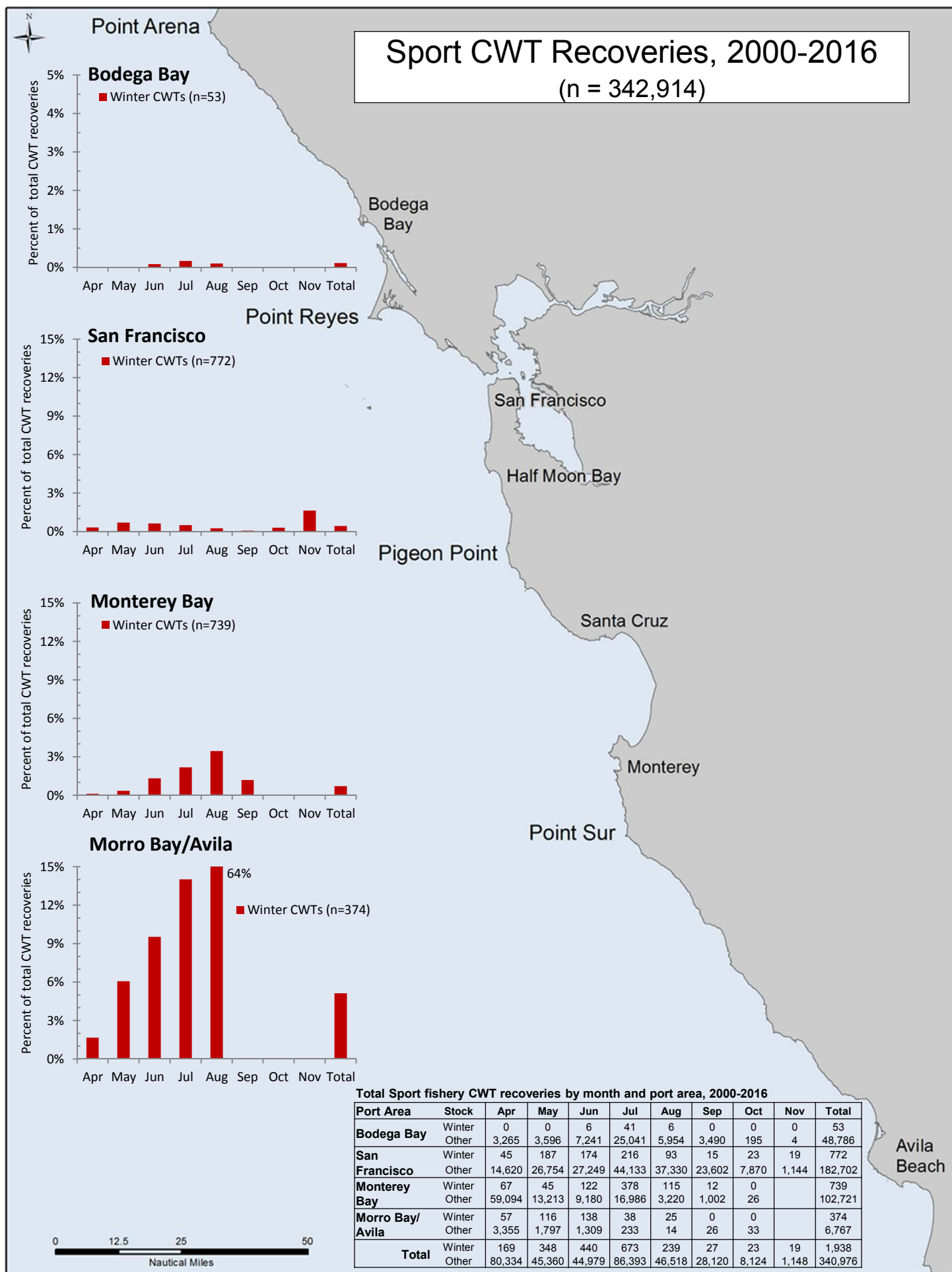


Figure 2. Proportion of winter CWT recoveries to total CWT recoveries (expanded) in ocean salmon sport fishery south of Pt. Arena by month and sub-port area, 2000-2016.

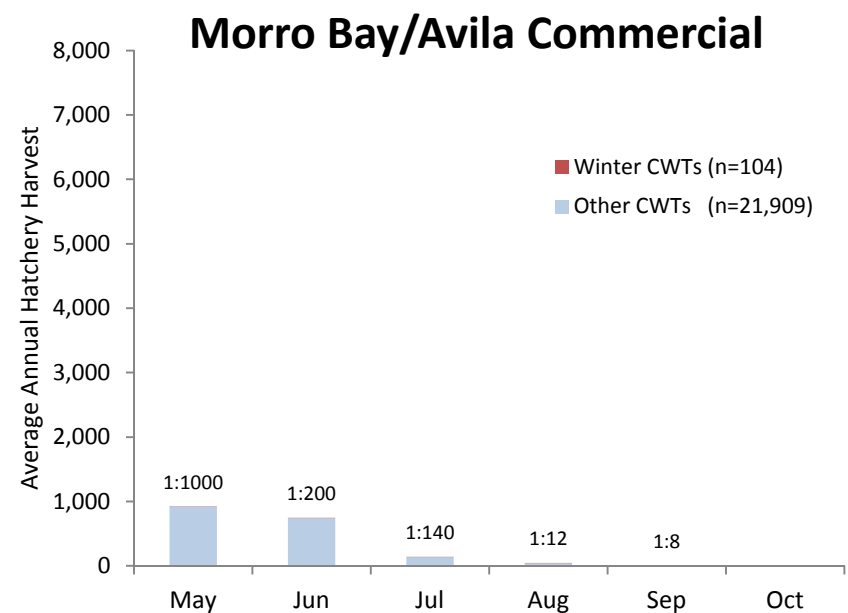
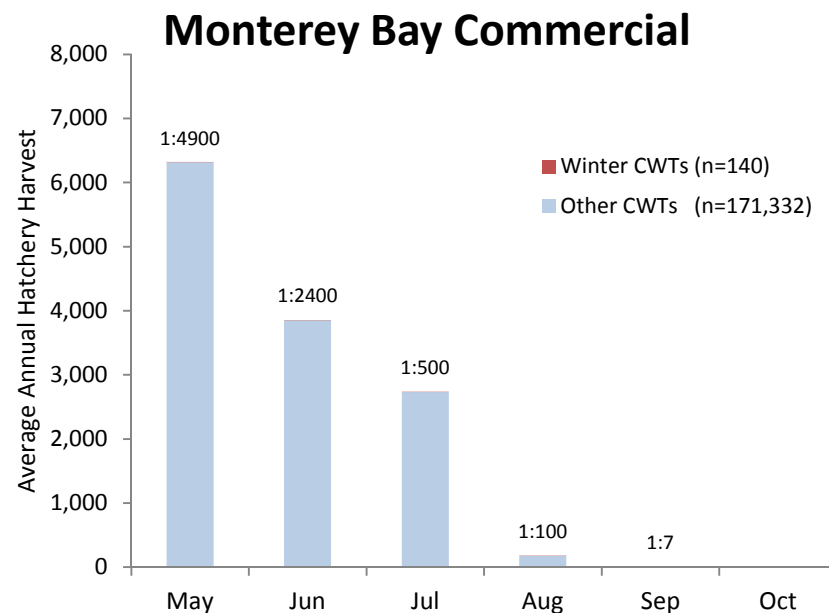
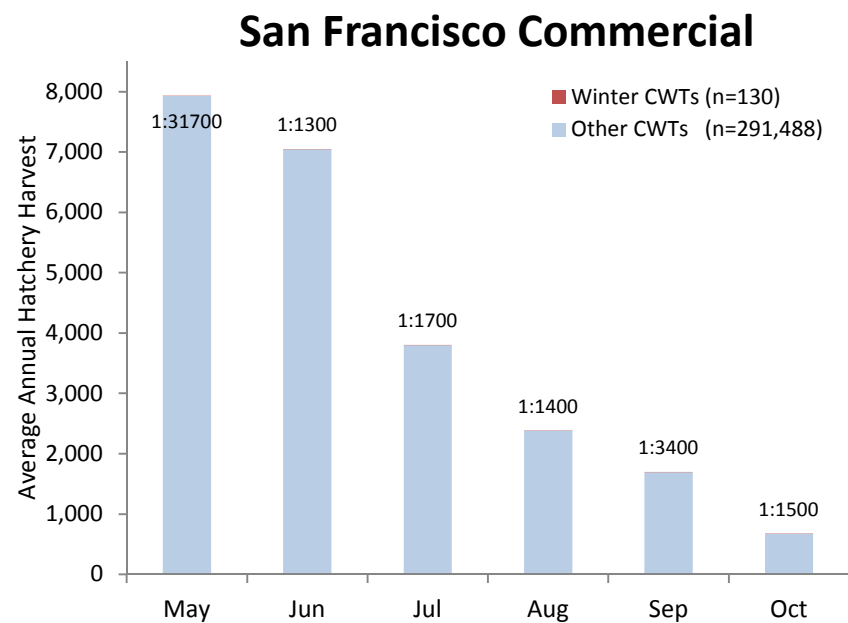
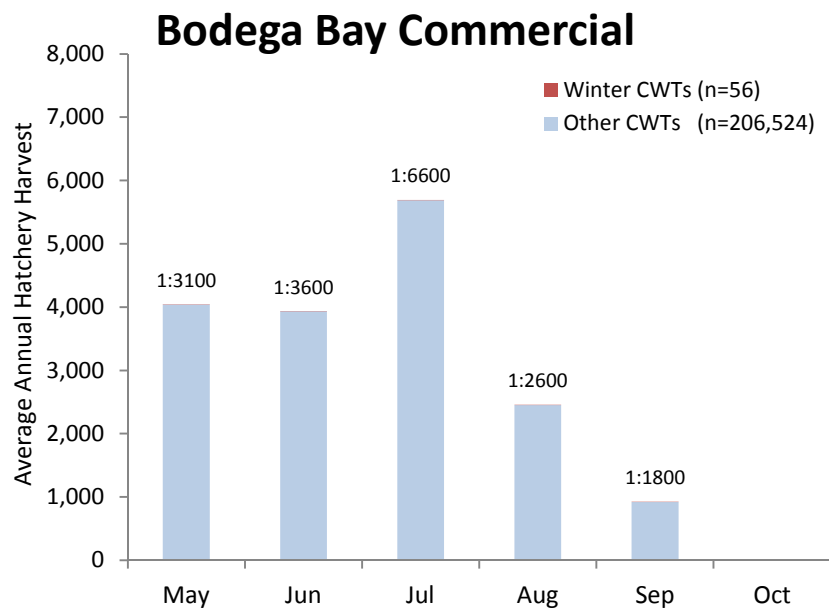


Figure 3. Average annual harvest of hatchery-origin winter-run (Winter) versus all other stocks (Other) in the ocean salmon commercial fishery south of Point Arena based on expanded CWT recoveries by sub-port area and month, 2000-2016. Ratio of Winter harvest to Other harvest above each bar.

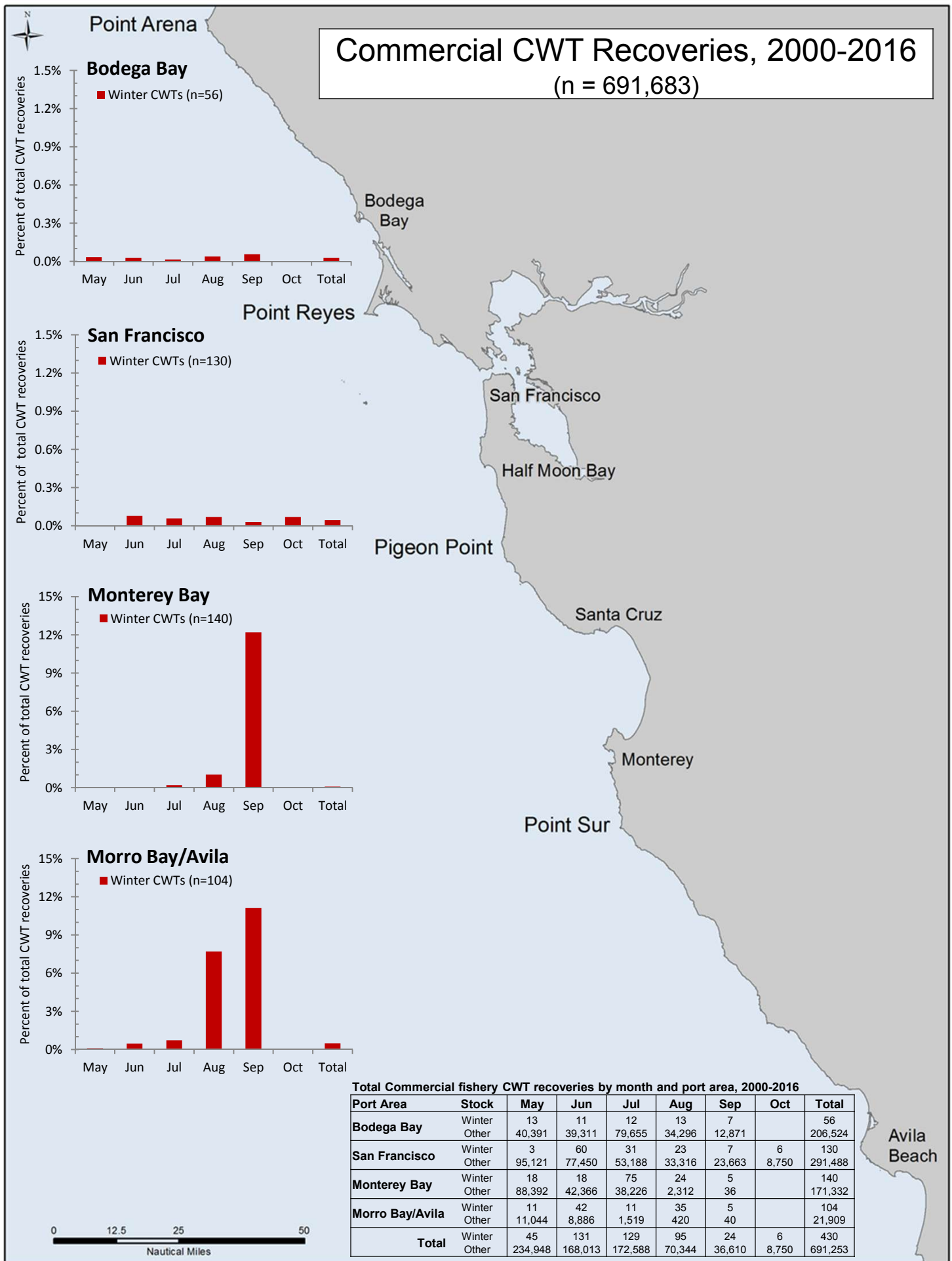


Figure 4. Proportion of winter CWT recoveries to total CWT recoveries (expanded) in ocean salmon commercial fishery south of Pt. Arena by month and sub-port area, 2000-2016.

