Errata Sheet
For

Incidental Takes and Interactions of Marine Mammals and Birds in Districts 6, 7, and 8 of the Southeast Alaska Salmon Drift Gillnet Fisher, 2012 and 2013

April 4, 2015

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Page 39, paragraph 4 is replaced with the following paragraph:

The mammal takes were in subdistricts 6A, 6B and 8A while the bird takes were in those subdistricts and also in subdistrict 7A. Taking these subdistricts into account it is estimated that the total take of live and dead common murres in subdistricts 6A, 6B and 8A in 2013 was 1124 with a 95% confidence interval of 711 to 1613, the total take of dead marbled murrelets in subdistricts 6A, 6B, 7A and 8A was 78 with a 95% confidence interval of 15 to 154, the total take of dead rhinocerus auklets in subdistricts 6A and 6B was 128 with a 95% confidence interval of 45 to 235, the total take of dead Cassin's auklets subdistrict 6A was 15 with a 95% confidence interval of 1 to 47, the total take of red throated loons in subdistrict 6A was also 15 with a 95% confidence interval of 1 to 47, the total take of live harbor porpoise in subdistricts 6A and 6B was 32 with a 95% confidence interval of 2 to 75, the total take of seriously injured harbor porpoises in subdistrict 8A was 23 with a 95% confidence interval of 2 to 56, the total take of live sea otters in subdistrict 6A was 15 with a 95% confidence interval of 1 to 47, and the total take of seriously injured humpback whales in subdistrict 8A was 11 with a 95% confidence interval of 1 to 36 (Table 5.3).

Incidental Takes and Interactions of Marine Mammals and Birds in Districts 6, 7 and 8 of the Southeast Alaska Salmon Drift Gillnet Fishery, 2012 and 2013

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1. Introduction

In 1972 the U.S. Congress enacted the Marine Mammal Protection Act (MMPA) to protect and conserve marine mammals. Congress stated that marine mammal populations should be "protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management and that the primary objective of their management should be to maintain the health and stability of the ecosystem."

The MMPA allows fishermen to incidentally (unintentionally) take marine mammals in the course of commercial fishing operations in the waters of the United States, provided they have been issued the appropriate authorization certificate and report any such takes. A "take" means to hunt, harass, capture or kill any marine mammal or to attempt to do any of those things. However, the intentional take of any marine mammal in the course of commercial fishing operations is prohibited.

Pursuant to the goals of the MMPA, the National Marine Fisheries Service (NMFS), which has the delegated responsibility and authority to manage marine mammals, is directed to assess the level and nature of marine mammal interactions with commercial fishing operations, including serious injury and mortality (SI/M). In Alaska, NMFS's Alaska Marine Mammal Observer Program (AMMOP) monitors marine mammal interactions with state-managed commercial fisheries. Information collected by the AMMOP is included in the annual Stock Assessment Reports (SARs) published by NMFS for all marine mammal stocks in U.S. waters. A "stock" is a group of marine mammals of the same species or subspecies in a common area that interbreed when mature. More information on SARs and links to the NMFS Alaska Marine Mammal Stock Assessment Reports can be found at the following website: http://www.nmfs.noaa.gov/pr/sars/

Each SAR contains information on the geographic range, population estimate and trend, and productivity rate for a given stock, as well as estimates of total annual human-caused SI/M to the stock, with SI/M rates by fishery, and a determination on whether or not that rate is insignificant and approaching a zero mortality rate goal (ZMRG). Achieving ZMRG is considered to be one of the primary goals of the MMPA. NMFS has defined a value of 10% of a stock's potential biological removal (PBR) as a criterion to evaluate whether the incidental SI/M of a stock is at an insignificant level approaching ZMRG.

The PBR level is the maximum number of animals that may be removed from a marine mammal stock, not including natural mortalities, and still allows that stock to reach or maintain its optimum sustainable population. A PBR for each stock is published in the stock's respective annual SAR and may change if any of the factors affecting the PBR has changed. Each stock's PBR is calculated by multiplying:

$$(N_{min})(0.5\ r_{max})(F_R),$$

where N_{min} is the minimum estimate of the population size for the stock, r_{max} is the maximum theoretical net productivity rate of the stock, and FR is a recovery factor between 0.1 and 1.0. The status of each stock is noted as either strategic or not in each annual SAR. A strategic stock is one that is listed as threatened or endangered under the Endangered Species Act (ESA), is likely to be listed as threatened under the ESA in the near feature, or which has a level of direct human-caused SI/M that exceeds the stock's PBR level.

The National Marine Fisheries Service publishes the List of Fisheries (LOF), an annually updated list of all commercial fisheries that legally operate in U.S. waters. The LOF contains information on each fishery, including number of participants, marine mammal stocks affected by the fishery, and the category of the fishery relative to its impact on those marine mammal stocks. Fishery categories range from I to III and are determined by the level of incidental SI/M of marine mammals by a given fishery relative to that marine mammal stock's PBR. NMFS relies on observer data in the analyses, but also evaluates other factors such as fishing techniques, gear, methods used to deter marine mammals, seasons and areas fished. Each fishery is categorized through an analysis with a two-tiered approach as follows:

Tier 1: Impact on a stock by all fisheries. For each marine mammal stock, SI/M from all commercial U.S. fisheries are totaled. If the total SI/M for that stock is less than or equal to 10% of the PBR of that stock, then all fisheries interacting with this stock are placed in Category III, and are considered to have met the ZMRG for that marine mammal stock. A marine mammal stock for which total serious injury and mortality from all fisheries exceeds 10% of PBR is subject to a Tier 2 analysis. Fisheries with no serious injuries or mortalities to any marine mammal remain in Category III.

Tier 2: Impact on a stock by individual fisheries. For the marine mammal stock being evaluated at the Tier II level, the annual SI/M for each fishery is evaluated relative to the PBR of that stock. Individual fisheries that meet Category III criteria as a result of the Tier II analysis are considered to have met ZMRG for that marine mammal stock. Each fishery is categorized for the LOF accordingly:
Category I: Mortality and Serious Injury $\geq$ 50% PBR
Category II: 50% PBR > Mortality and Serious Injury > 1% PBR
Category III: Mortality and Serious Injury $\leq$ 1% PBR

Each commercial fishery is ultimately placed in the LOF in the highest category achieved during the Tier analysis. The most recent annual LOF and those for previous years may be found at the website http://www.nmfs.noaa.gov/pr/interactions/lof/.

NMFS may require monitoring for marine mammal interactions with any Category I or II fishery. Depending on the results of the observations, the fishery may remain in the same category or may be re-categorized. Category III fisheries are not required to be observed since the level of marine mammal serious injury or mortality is considered to be rare or zero.

The Alaska Marine Mammal Observer Program

The AMMOP was set up in 1990 to monitor Alaska state commercial fisheries by obtaining reliable estimates of the level of incidental serious injury and mortality of marine mammals during fishing operations, determining the reliability of reports submitted by vessel owners and operators, identifying changes in fishing methods or technology that may increase or decrease incidental serious injuries and mortalities, collecting biological samples that may otherwise be unobtainable for scientific studies, and recording data on incidental take levels of all marine mammal species.

Although the collection of data on the incidental injury and mortality of seabirds during fishing operations is not part of these goals, the collection of such data is fully supported and considered to be an important secondary benefit from the program.

As part of this program, NMFS places observers in Alaskan fisheries on a rotational basis, to gather data to monitor the level and nature of incidental mortalities and serious injuries. AMMOP observers are not deployed directly on the fishing vessel being observed, but rather they deploy to the fishing grounds on independent vessels which are positioned in proximity to the fishing operations to better collect data on fishing operations including at and below the water's surface. As noted above, these data are incorporated into the Alaska SARs and are also used for various management requirements including the placement of Alaska federal and state commercial fisheries into the appropriate fisheries category under the LOF. There are currently no Category I fisheries in Alaska, and Category II fisheries have priority for AMMOP observer coverage. Category III fisheries are not required to accommodate observers and therefore unlikely to be covered by the AMMOP.

The AMMOP began observer coverage in 1990 and 1991 on the Prince William Sound set and drift gillnet fisheries, and the Aleutian Peninsula drift gillnet fisheries (Wynne *et al*., 1991, 1992). It continued with the Cook Inlet set and drift gillnet fisheries in 1999 and 2000 (Manly, 2006), covered the Kodiak Island set gillnet fishery in 2002 and 2005 (Manly, 2007a), and the Yakutat set gillnet fishery in 2007 and 2008 (Manly, 2010a). The last observer program covered the drift gillnet fishery in districts 6, 7 and 8 in the Southeast Alaska drift gillnet fishery in 2012 and 2013, and the present report describes the results of that program. More information about the AMMOP program including the manual used by observers and copies of earlier reports on the fisheries that have been observed are available at the AMMOP website (http://alaskafisheries.noaa.gov/protectedresources/observers/mmop.htm).

2. The Southeast Alaska Drift Gillnet Fishery

There are five Alaska Department of Fish and Game (ADF&G) Districts in the Southeast Alaska drift gillnet fishery, consisting of Tree Point, Prince of Wales, Stikine, Taku/Snettisham, and Lynn Canal, as shown on Figure 2.1. In addition, some fishing is permitted in terminal harvest areas that are adjacent to hatchery facilities, some is permitted for hatchery cost recovery, and some is permitted at Annette Island. The Annette Island Fishery Reserve was established by a Presidential Proclamation in 1916. It provides a 3,000 foot offshore zone where the reserve natives have exclusive fishing rights. Most salmon caught by drift gillnets are from the five main fishing areas and the terminal harvest areas, with smaller contributions from Annette Island, and hatchery cost recovery.

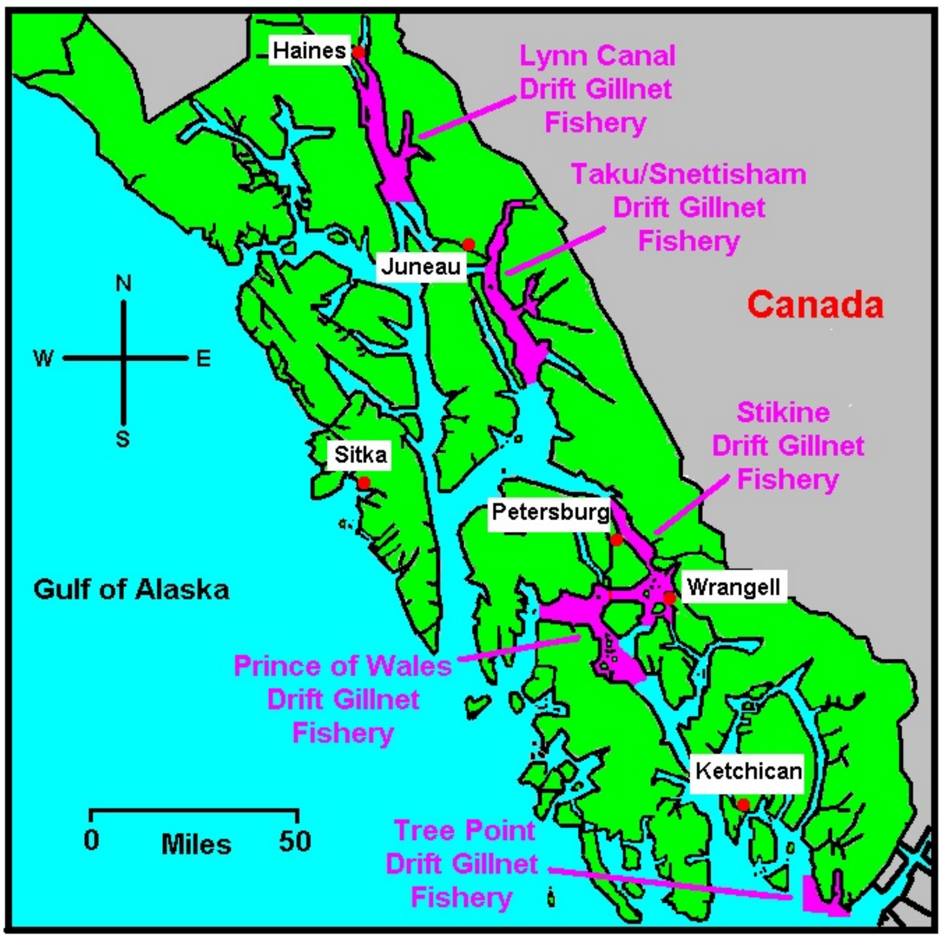

Figure 2.1 The drift gillnet fisheries in Southeast Alaska. Drift gillnet fishing is also permitted at times in several THAs (terminal harvest areas adjacent to hatchery facilities).

An initial consideration of possible sampling plans for Southeast Alaska showed that with the resources available it would not be possible to observe all of the drift gillnet fishery in one year. Further consideration then led to the conclusion that the most reasonable plan was to first observe the Prince of Wales, Stikine and Anita Bay terminal harvest area fisheries in 2012 and 2013, because these three fisheries are close together which simplified the logistics of sampling. The sampling of drift gillnet fishing in other parts of Southeast Alaska would then be planned after the completion of this sampling.

The Prince of Wales, Stikine and Anita Bay Fishing in 2012 and 2013

As shown in Figure 2.2, the Southeast Alaska drift gillnet fishery locations are divided into districts, these districts are divided into subdistricts and the subdistricts are divided into smaller statistical areas, with the Prince of Wales fishing in district 6, the Anita Bay fishing in district 7, and the Stikine fishing in district 8. In 2012 and 2013 the Prince of Wales fishing was only in statistical area 10630 in subdistrict 6B and statistical areas 10641 and 10642 in subdistrict 6A (Table 2.1), the district 7 fishing was only in Anita Bay in statistical area 10735 in subdistrict 7A, and the Stikine fishing was only in statistical areas 10810, 10820, 10830 and 10840 in subdistrict 8B and statistical areas 10850 and 10860 in subdistrict 8A (Table 2.2). Therefore AMMOP limited observer cover to districts 6 (A, B), 7 (A) and 8 (A,B).

Table 2.1 The statistical areas in district 6, Prince of Wales. In 2012 and 2013 there was no drift gillnet fishing in subdistrict 6D or the terminal harvest areas. There is no fishing in subdistrict 6C adjacent to statistical area 10630.

Statistical Area	Subdistrict	Location
10610	6D	Ratz Harbor Shore*
10620	6D	Rocky Bay/McHenry Anchorage*
10622	6D	Burnett, Mosman, McHenry Inlet*
10625	6D	Burnett Inlet Terminal Harvest Area*
10630	6B	Upper Clarence/Steamer Bay/Quiet Harbor
10635	6B	Neck Lake Terminal Harvest Area*
10641	6A	Sumner Strait/Point Baker/Macnamara
10642	6A	Kah Sheets/St Johns
10643	6A	Duncan Canal*
10644	6A	Wrangell Narrows*

*No drift gillnet fishing in 2012 or 2013.

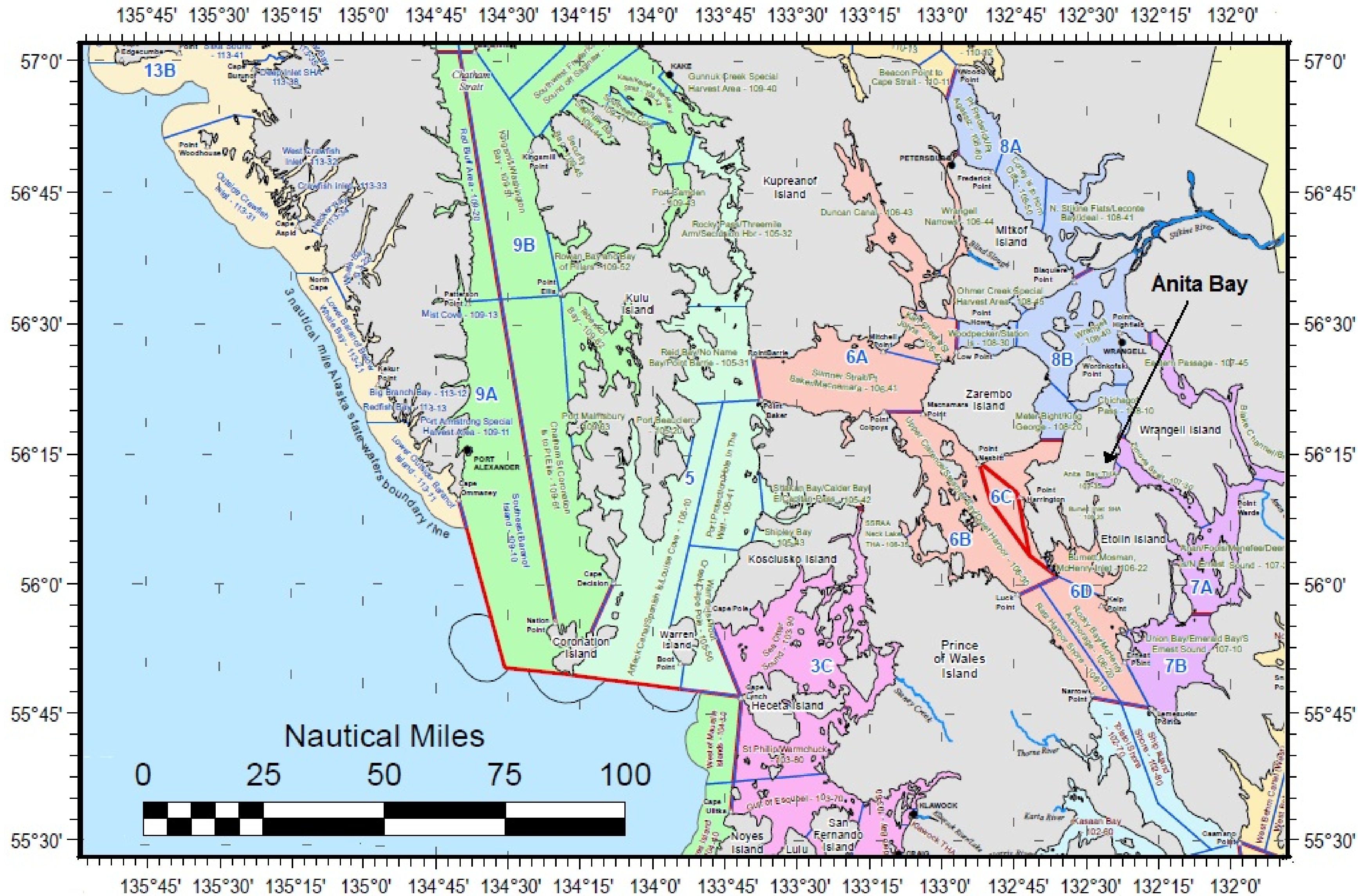

Figure 2.2 Districts 6 (Prince of Wales) and 8 (Stikine) and Anita Bay in district 7 in the Southeast Alaska drift gillnet fishery.

Table 2.2 The statistical areas in district 8, Stikine. In 2012 and 2013 there was no fishing in statistical areas 10841 and 10845.

Statistical Area	Subdistrict	Location
10810	8B	Chichagof Pass
10820	8B	Meter Bight/King George
10830	8B	Woodpecker/Station Island
10840	8B	Wrangell
10845	8B	Ohmer Creek Special Harvest Area*
10841	8A	North Stikine Flats/Leconte Bay*
10850	8A	Coney Island to Hom Cliffs
10860	8A	Point Frederick/Point Agassiz

*No drift gillnet fishing in 2012 or 2013.

Marine Mammals and Birds in Southeast Alaska

The surveys from 1997 to 2002 of nearshore waterbirds reported by Hodges *et al*. (2008) provide information about the marine birds likely to be close to drift gillnet fishing in Southeast Alaska. Boat and air surveys were conducted in winter and summer, with the summer boat survey numbers that are provided in Table 2.3. However marbled murrelets, ancient murrelets, Cassin's auklets and storm petrels are also known to be common in southeast Alaska (K. Kuletz, private communication). Hodges *et al*. (2008) also note that the summer boat surveys resulted in 725 sea otters and 2543 harbor seals being observed, suggesting that these are the most commonly observed marine mammals in Southeast Alaska. However Agler *et al*. (1995) report multiple sightings of Pacific white-sided dolphins, harbor porpoises, Dall's porpoises, Stellar sea lions, grey whales, humpback whales and killer whales, plus one sighting of a minke whale, in addition to many sightings of sea otters and harbor seals during a small boat survey of Southeast Alaska in the summer of 1994.

Interactions with Marine Mammals Documented Before 2012

According to the 2011 Alaska marine mammal stock assessments (Allen and Angliss, 2012, Appendix 4) the species recorded as taken incidentally in the Southeast Alaska drift gillnet fishery based on records from 1988 onwards are Steller sea lions, harbor seals, harbor porpoises, Dall's porpoise, Pacific white-sided dolphins, and humpback whales. Table 2.4 gives information about these species concerning the stocks involved, the estimated population sizes, the potential biological removals (PBR), the estimated fishery mortalities, and the status of the stocks.

Table 2.3 Observed birds of different species in summer surveys of Southeast Alaska as reported in Table 1 of Hodges *et al*. (2008) from 1997 to 2002.

Species	Observed	Species	Observed
Red-throated Loon	62	Harlequin Duck	8742
Pacific Loon	50	Long-tailed Duck	12
Common Loon	135	Goldeneye spp.	176
Yellow-billed Loon	1	Red-breasted Merganser	61
Loon spp.	30	Common Merganser	61
Red-necked Grebe	4	Merganser spp.	4000
Horned Grebe	7	Black Oystercatcher	221
Grebe spp.	13	Glaucous-Winged Gull	8992
Double-crested Cormorant	7	Herring Gull	2787
Pelagic Cormorant	2099	Mew Gull	34813
Cormorant spp.	438	Bonaparte's Gull	7607
Great Blue Heron	51	Black-legged Kittiwake	9229
Trumpeter Swan	1	Gull spp.	4591
Canada Goose	1408	Arctic Tern	277
Mallard	455	Caspian Tern	10
Green-winged Teal	67	Pigeon Guillemot	1405
American Wigeon	39	Rhinoceros Auklet	3098
Northern Pintail	1	Common Murre	1808
Scaup spp.	32	Tufted Puffin	187
White-winged Scoter	4251	Horned Puffin	120
Black Scoter	2	Common Raven	182
Surf Scoter	32590	Northwestern Crow	7065
Scoter spp.	11828		

Table 2.4 Information about the marine mammal species recorded as incidental takes in the Southeast Alaska drift gillnet fishery based on the report of Allen and Angliss (2012).

Species	Stock	Estimated Size	CV[1]	PBR[2]	Fishing Mortality	Strategic[3]
Dall's porpoise	Alaska	83400	9.7%	N/A[4]	28.4	No
Harbor porpoise	SE Alaska	11146	24.2%	N/A	22.8	Yes
Harbor seal	Sitka/Chatham	8586	5.1%	247	N/A	No
Harbor seal	Dixon/Cape Decision	14388	6.0%	821	N/A	No
Harbor seal	Clarence Strair	23289	4.2%	1348	N/A	No
Humpback whale	Central N Pacific	7469	30.0%	61.2	3.8	Yes
Pacific white-sided dolphin	Central N Pacific	26880	N/A	N/A	0	No
Steller sea lion	Eastern US	528475	N/A	2378	33.5	Yes

[1]CV = coefficient of variation (%) for the estimated population size.
[2]PBR = the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.
[3]The term strategic stock means a marine mammal stock (1) for which the level of direct human-caused mortality exceeds the potential biological removal level; (2) which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the Endangered Species Act (ESA) within the foreseeable future; or (3) which is listed as threatened or endangered under the ESA, or is designated as depleted under the MMPA.
[4]N/A means not available.

3. Sampling Methods

This section of the report gives an outline of the sampling and data collection methods used in Southeast Alaska. More details about these methods are provided in the AMMOP Observer Manual (AMMOP, 2013) and in the 2012 post-season report provided by Saltwater Inc. (2013).

Choice of the Sampling Design

Initially consideration was given to sampling using a stratified sampling design as in previous AMMOP surveys (Manly, 2010b). This would then have involved dividing Districts 6 and 8 into the subareas 6A, 6B, 8A and 8B as defined in Tables 2.1 and 2.2 and treating these plus Anita Bay in subdistrict 7A as five strata. Each of the strata would then be sampled so that as far as possible the number of permits sampled in a stratum during an opener is proportional to the number of permit holders fishing. For example, if the target sampling level is 5% then about 5% of the permit holders fishing should be sampled in each of the strata for each day of an opener.

Unfortunately this standard stratified sampling design was not practical because a permit holder is free to fish in any area in Southeast Alaska that is open on a given day. Therefore a permit holder can fish in more than one of the strata during a day, or even move out of the five strata to fish in another subdistrict. For this reason it was decided to use post-stratified sampling in 2012 and 2013. As noted by Cochran (1977, Section 5A.9) this is almost as precise as stratified sampling with proportional allocation of sampling effort to the strata providing that the sample sizes in the strata are not too small. Basically a post-stratified sample is treated in the same way as a stratified sample but the allocation of a sample to a stratum (e.g. to one of 6A, 6B, 7A, 8A or 8B) is done after the sample data are collected, based on the location where fishing began for a day.

The report by Manly (2010b) also considered some alternative sampling designs that are intended to put more sampling effort in areas where take of marine mammals or birds is observed rather than areas without observed takes. One of these was adaptive sampling, where the sampling results from one opener are used to determine whether there should be extra sampling in the following opener, and where the extra sampling should take place. Another possibility considered was hot-spot sampling where the fishery is divided into standard strata plus a hot-spot stratum where higher takes of marine mammals and birds are expected for some reason.

It was decided before sampling began in 2012 that the relatively simple post-stratified sampling design would be used and that the adaptive sampling and hot-spot sampling designs would only be considered for use if areas with large takes of marine mammals or birds were found to exist. After sampling began it became apparent that the post-stratified sampling design was satisfactory and that no changes to this design were needed because of the low takes of marine birds and the absence of marine mammal takes in all parts of the fishery.

Sampling Strata

As noted above, the strata used for poststratification are 6A, 6B, 7A, 8A and 8B. Therefore, based on where drift gillnet fishing took place in 2012 and 2013, the statistical areas for each of the strata are 6A (10641, 10642), 6B (10630), 7A (10735), 8A (10850, 10860) and 8B (10810, 10820, 10830, 10840) based on the statistical area where fishing began on an observed day.

Tracking of Total Fishing Effort

Lead observers were responsible for tracking the total fishing effort by all permit holders in their areas on a daily basis because this information was needed to quantify the total fishing effort in the fishery for the whole of the 2012 and 2013 fishing seasons. This information was obtained by interviewing the permit holders either in person or by telephone.

Sample Selection

At the start of the 2012 season, permit holders selected for observation in Anita Bay were selected from a single randomized list developed for fishing in districts 6 and 8 (i.e., a list of the permit holders that expected to fish in these districts during an opener, with the names in a random order). Then in early July it was realized that when permit holders were selected from the district 6 and 8 list for observation in Anita Bay they were being under-sampled. This is because Anita Bay is open for fishing in periods outside of the district 6 and 8 weekly openers. Thus permit holders fishing in both Anita Bay and district 6 and 8 fish more often than those just fishing in districts 6 and 8. The sample selection procedure was therefore adjusted to include a separate randomized list for Anita Bay that included all permit holders expected to fish in Anita Bay. The permit holders fishing in Anita Bay in an opener were then selected for observation based on their order in that list.

With both randomized lists of permit holders those selected to be observed were chosen in the order on the list until the list was exhausted. At that time a new randomized list was developed for further sampling.

If a permit holder was chosen to be observed but was not fishing for some reason then the next available permit holder on the list was chosen instead. In that case the first permit holder remained on the list and was the first choice for being observed in the next opener when they did fish.

Data Recorded

The sampling of the fishing for one permit holder on one day is called a trip. On a trip observers attempted to record data for all of the sets, soaks and hauls by the permit holder, where the set consists of putting the net in the water, the soak is the period when the net is left undisturbed in the water, and a haul consists of taking all or part of the net out of the water and removing any fish that are caught. If all or part of a haul could not be observed for any reason, such as bad weather, then the fraction that was observed was recorded. Any interactions with marine mammals or birds that were observed while nets were being set or were soaking were also recorded.

During a sample day observers also recorded data on the environmental conditions such as the water depth and temperature, the air temperature, the weather and tidal conditions, and the gear characteristics. An Appendix to this report contains copies of the forms used for recording this information.

Planned Observer Coverage

The report by Manly (2010b) discusses the sample size required for sampling the whole of the drift gillnet fishery in Southeast Alaska based on stratified sampling and other possible sampling methods. Based on these results and cost considerations it was decided that the target level of cover for the sampling of Districts 6 and 8 and Anita Bay in 2012 and 2013 should be 7.5%. It was also decided that in order to achieve this target level it was necessary to aim for a slightly higher level when allocating the number of observers for an opener in order to allow for observers sometimes not being present for all of the hauls made by a permit holder during a trip.

4. The Total Fishing Effort and the Observer Cover

There are two factors that need to be considered when calculating the coverage of the Southeast Alaska Drift Gillnet fishery in 2012 and 2013. First, the actual total fishing effort will be less than the effort that would occur if all the permit holders present during an opener fished for the entire open period. For example, if an opener was from midday Sunday to Midday Monday then a permit holder could fish for 24 hours but in practice this did not always occur. Therefore in calculating the total fishing effort in terms of 24 hour periods the number of hours actually fished needs to be taken into account, where this information was collected by observers for an opener after the opener ended.

A second consideration is the number of hours that a permit holder selected for observation on a day during an opener was observed fishing. This was often the entire period fished by the permit holder but was less if the observer arrived after the permit holder started fishing or for some reason had to leave before the fishing was ended for the day. There is then the possibility that some sets, soaks or hauls occurred before an observer arrived or after they left. The observers collected data on all of the set, soak and haul times while they were observing a permit holder. The total observation time was therefore calculated as the last recorded end haul time minus the first set or haul start time, with an adjustment if the first set or the last haul was not fully observed which was recorded as the percentage of the net observed being less than 100%. If less than 100% of the net was observed at the first haul then the observer start time was assumed to be after the haul started. For example, if only 25% of the net was observed then it is assumed that the start of the observation time was after 75% of the haul time. Similarly, if less that 100% of the net was observed for the last haul then the observer end time was assumed to be before the haul was over. For example, if only 25% of the net for the last haul was observed then it was assumed that the observer stopped observing after 25% of the haul time.

Based on the recorded fishing times for permit holders it is possible to allocate these times to the fishing weeks, with week 24 starting on Sunday 10 June in 2012 and Sunday 9 June in 2013, and to the subdistrict 6A, 6B, 7A, 8A or 8B where the fishing began. Similarly, the hours that observers were observing permit holders can be allocated to the fishing weeks and subdistricts where fishing began. The percentage cover for each subdistrict in each fishing week is then the total observed hours as a percentage of the total fished hours.

Observer Cover in 2012

Table 4.1 shows total fishing effort in days, the observed effort in days and the resulting percentage cover of the fishery for fishing weeks 24 to 39 and subdistricts 6A, 6B, 7A, 8A and 8B in 2012. Overall the percentage cover based on the hours fished and the hours observed is 6.4%, with the coverage in different fishing weeks varying from 4.9% to 8.8% and the cover in different subdistricts varying from 5.5% to 7.3%. In 2012 the overall cover was therefore a little less that the target level of 7.5%.

Table 4.1 The total fishing effort by all permit holders in days (24 hour periods), the observed fishing effort in days, and the resulting percentage cover of the fishing, for fishing weeks 24 to 39 and subdistricts 6A, 6B, 7A, 8A and 8B in 2012. Blanks in the table indicate no fishing and no cover.

	Start	Total Fishing Effort in Days						Observed Fishing Effort in Days						Percentage Cover					
Week	Date	6A	6B	7A	8A	8B	Total	6A	6B	7A	8A	8B	Total	6A	6B	7A	8A	8B	Total
24	10 June			14.4			14.4			1.1			1.1			8.0			8.0
25	17 June	40.4	11.9	8.1	12.2	48.4	121.1	2.4	0.2	0.8	0.8	3.1	7.4	6.0	1.8	10.3	6.7	6.4	6.1
26	24 June	46.7	11.3	16.9	6.9	54.3	136.1	3.7	0.0	0.6	0.9	2.9	8.1	7.9	0.0	3.5	12.4	5.4	5.9
27	1 July	45.3	50.4	18.7	14.4	39.0	167.9	3.8	1.8	0.9	1.9	2.8	11.2	8.4	3.5	4.6	13.4	7.3	6.7
28	8 July	30.3	37.5	28.1	23.5	75.8	195.2	1.5	3.7	1.5	0.6	3.9	11.2	4.9	9.9	5.3	2.6	5.1	5.7
29	15 July	20.4	40.7	28.6	14.5	78.6	182.7	1.1	2.3	1.2	1.7	5.2	11.5	5.3	5.7	4.3	11.9	6.6	6.3
30	22 July	37.8	48.2	44.2	13.8	97.9	241.8	3.4	2.4	1.7	0.2	4.7	12.4	8.9	5.0	3.9	1.8	4.8	5.1
31	29 July	24.5	34.1	39.3	11.8	75.9	185.7	1.4	1.6	2.9	0.3	4.3	10.5	5.5	4.8	7.4	2.9	5.7	5.7
32	5 Aug	28.8	52.3	15.4	5.9	40.2	142.6	2.2	2.7	1.7	0.1	3.2	9.9	7.5	5.2	11.3	1.4	8.0	6.9
33	12 Aug	26.1	52.8	1.6	11.2	11.0	102.7	1.9	2.8	0.0	1.2	1.7	7.6	7.1	5.4	0.0	10.9	15.1	7.4
34	19 Aug	11.9	30.2	1.8	11.5	8.2	63.6	1.6	2.4	0.0	1.2	0.5	5.6	13.3	7.9	0.0	10.0	5.5	8.8
35	26 Aug	27.0	23.8	0.5	13.6	18.2	83.0	1.9	1.7	0.3	1.3	1.4	6.7	7.0	7.3	61.1	9.7	7.7	8.0
36	2 Sept	53.1	48.3		17.4	19.9	138.7	4.8	3.5		0.4	1.2	9.8	8.9	7.2		2.3	6.1	7.1
37	9 Sept	59.2	11.5	5.8	3.7	17.1	97.2	3.8	1.1	0.7	0.3	1.4	7.3	6.5	9.3	12.2	7.6	8.5	7.5
38	16 Sep	30.9	55.2	0.3	3.2	16.4	106.0	1.6	1.8	0.0	0.3	1.5	5.2	5.2	3.3	0.0	8.4	9.3	4.9
39	23 Sept	14.9	3.8	2.8	1.0	5.2	27.7	1.2	0.3	0.0	0.2	0.5	2.2	8.4	7.3	0.0	17.8	10.4	8.1
	Total	497.4	512.0	226.6	164.8	605.8	2006.5	36.1	28.4	13.5	11.4	38.3	127.8	7.3	5.5	6.0	6.9	6.3	6.4

Observer Cover in 2013

Table 4.2 shows total fishing effort in days, the observed effort in days and the resulting percentage cover of the fishery for fishing weeks 24 to 38 and subdistricts 6A, 6B, 7A, 8A and 8B in 2013. Overall the percentage cover based on the hours fished and the hours observed is 6.6%, with the cover in different fishing weeks varying from 3.3% to 8.8% and the cover in different subdistricts varying from 5.7% to 8.9%. In 2013 the cover was therefore again a little less that the target level of 7.5%. There is no information available about the total fishing effort after week 38 as observing stopped in that week.

Although the cover in 2013 of 6.6% of the fishing hours is similar to the 6.4% coverage in 2012 the total fishing effort by permit holders was much higher in 2013 than in 2012 because the observers recorded a total fishing effort of 2006.5 days in 2012 but 2708.6 days in 2013. This difference was due to the pink and coho salmon runs being much higher in 2013 than in 2012. This altered the fishing patterns in subdistricts 6 and 8, with more boats fishing in July and August and many more open days in 2013 than in 2012.

Table 4.2 The total fishing effort by all permit holders in days (24 hour periods), the observed fishing effort in days, and the resulting percentage cover of the fishing, for fishing weeks 24 to 38 and subdistricts 6A, 6B, 7A, 8A and 8B in 2013. Blanks in the table indicate no fishing and no cover.

	Start	Total Fishing Effort in Days						Observed Fishing Effort in Days						Percentage Cover					
Week	Date	6A	6B	7A	8A	8B	Total	6A	6B	7A	8A	8B	Total	6A	6B	7A	8A	8B	Total
24	9 June			24.2			24.2			0.8			0.8			3.3			3.3
25	16 June	36.1	13.3	22.4	7.9	59.2	139.0	2.9	0.3	2.5	0.8	3.8	10.4	8.1	2.4	11.1	10.4	6.4	7.5
26	23 June	40.1	19.4	10.3	9.5	63.6	142.9	3.7	2.0	2.7	1.3	2.4	12.1	9.1	10.3	26.4	14.2	3.7	8.5
27	30 June	39.9	51.3	2.8	9.7	36.4	140.0	3.3	4.7	0.3	1.9	1.2	11.5	8.2	9.3	11.7	19.7	3.3	8.2
28	7 July	48.4	39.3	23.5	11.7	37.0	159.8	2.5	1.9	1.4	1.4	2.4	9.6	5.3	4.8	5.9	11.7	6.5	6.0
29	14 July	44.9	51.5	28.2	10.6	61.7	196.9	2.7	1.9	2.0	0.1	6.9	13.7	6.1	3.7	7.1	1.1	11.2	6.9
30	21 July	35.0	74.7	50.1	12.7	75.6	248.1	3.4	3.1	3.4	0.0	3.4	13.3	9.6	4.1	6.9	0.0	4.5	5.3
31	28 July	57.8	108.5	23.3	24.4	79.9	293.9	4.3	3.8	1.5	2.6	4.1	16.3	7.4	3.5	6.3	10.5	5.2	5.5
32	4 Aug	39.7	84.5	11.2	43.4	40.6	219.4	1.4	4.8	0.6	4.1	2.0	12.8	3.5	5.6	5.1	9.4	4.9	5.8
33	11 Aug	67.9	64.5	5.5	48.5	40.0	226.5	4.8	6.1	0.7	3.5	1.5	16.7	7.1	9.5	13.2	7.2	3.6	7.4
34	18 Aug	68.6	63.9	6.0	57.3	19.7	215.4	3.3	4.1	0.7	4.2	1.8	14.2	4.9	6.4	12.1	7.4	9.3	6.6
35	25 Aug	77.6	41.1	1.0	47.2	20.2	187.2	6.4	4.0	0.0	4.2	1.9	16.5	8.2	9.7	0.0	8.8	9.5	8.8
36	1 Sept	99.7	30.3		21.2	44.5	195.8	4.8	2.1		2.2	2.5	11.6	4.8	6.9		10.4	5.6	5.9
37	8 Sept	96.5	70.6	6.5	15.7	27.8	217.1	8.5	4.1	0.0	1.9	0.9	15.3	8.8	5.8	0.0	11.9	3.1	7.1
38	15 Sept	58.2	21.1	5.0	3.9	14.3	102.5	2.6	0.8	0.7	0.6	0.3	5.0	4.4	4.0	14.4	14.3	2.4	4.9
	Total	810.3	733.9	219.9	323.7	620.7	2708.6	54.6	43.7	17.4	28.7	35.1	179.6	6.7	6.0	7.9	8.9	5.7	6.6

Observed Cover Levels Based on the Observed Salmon Catch

A check on the above calculated observer cover rates in 2012 and 2013 involves seeing what percentages of the total salmon catches in those years were caught by the observed permit holders. This is because the observers were required to record the catches for the permit holders that they observed in terms of pounds of fish. The total pounds recorded by observers can then be compared with the total catches based on the Alaska Department of Fish and Game's (ADF&G) fish ticket records as provided by the ADF&G on June 24, 2014.

In 2012 the AMMOP observers recorded 479,539 pounds of kept drift gillnet salmon catch in subdistricts 6A, 6B, 7A, 8A and 8B while the fish ticket records show that the total catch for that year was 6,930,993 pounds. On that basis 6.9% of the total catch was observed, which is slightly more than the 6.4% calculated based on the observed fishing hours. In 2013 the AMMOP observers recorded 449,216 pounds of kept drift gillnet salmon catch in subdistricts 6A, 6B, 7A, 8A and 8B while the fish ticket records show that the total catch for that year was 7,092,573 pounds. On that basis 6.3% of the total catch was observed, which is slightly less than the 6.6% calculated based on the observed fishing hours. There is therefore reasonable agreement between the coverage based on the hours of fishing observed and the coverage based on the salmon catch of observed permit holders.

5. Ratio Estimation of Total Takes

A major objective of the AMMOP program is to estimate the total number of yearly takes of different species of marine mammals and birds in fisheries, and also the number of takes with serious injury or mortality. Estimates of take numbers are therefore provided here for the subdistricts 6A, 6B, 7A, 8A and 8B where takes occurred in 2012 or 2013, based on ratio estimation. Basically the observer data for a subdistrict is used to estimate the take of a species per day (i.e., 24 hour period) of fishing. This take per day is then multiplied by the total number of days of fishing by permit holders for the whole season in the subdistrict to get the estimated total take. Table 5.1 shows the locations of the marine mammal takes in the two years.

The calculation of the total fishing effort and the observed effort in each subdistrict in each fishing week is discussed in Section 4, with the results of the calculations shown in Tables 4.1 for 2012 and Table 4.2 for 2013. For a subdistrict the total fishing effort in days in all weeks is denoted by T_e which is assumed to be recorded with a negligible error, and the total observed fishing effort in days for all observed weeks in the subdistrict is denoted by T_s, which is again assumed to have a negligible error. Also, the total observed take in the subdistrict for all of the observed weeks for a marine mammal or bird species or group of species is denoted by T_c where this is either all takes or just the takes with serious injuries or mortalities.

Using this notation the take rate in the subdistrict per observed fishing day for the species or groups of species being considered is estimated to be

$$R = T_c / T_s, \qquad (5.1)$$

and an obvious estimate of the total take is this observed daily take rate multiplied by the total fishing days in the subdistrict, or

$$T = R\, T_e. \qquad (5.2)$$

This is a ratio estimator. Standard theory (Sheaffer *et al*., 1990, p. 155) provides equations for estimating the standard errors, coefficients of variation and approximate 95% confidence limits for the true total take numbers. However, bootstrap methods were used instead to obtain estimates of coefficients of variation and percentile bootstrap confidence limits (Manly, 2007b, p. 46) because of the many low observed take numbers in 2012 and 2013.

Estimated Total Takes in 2012

There was little observed take in 2012. In total there were 13 common murre takes, as shown in Table 5.1, with 12 dead takes and one common murre released alive. All of these takes were in subdistrict 6A. Also, there was only one marine mammal take which was a Dall's porpoise taken in subdistrict 6B in week 32 and released alive but seriously injured. No takes were observed in subdistricts 7A, 8A or 8B.

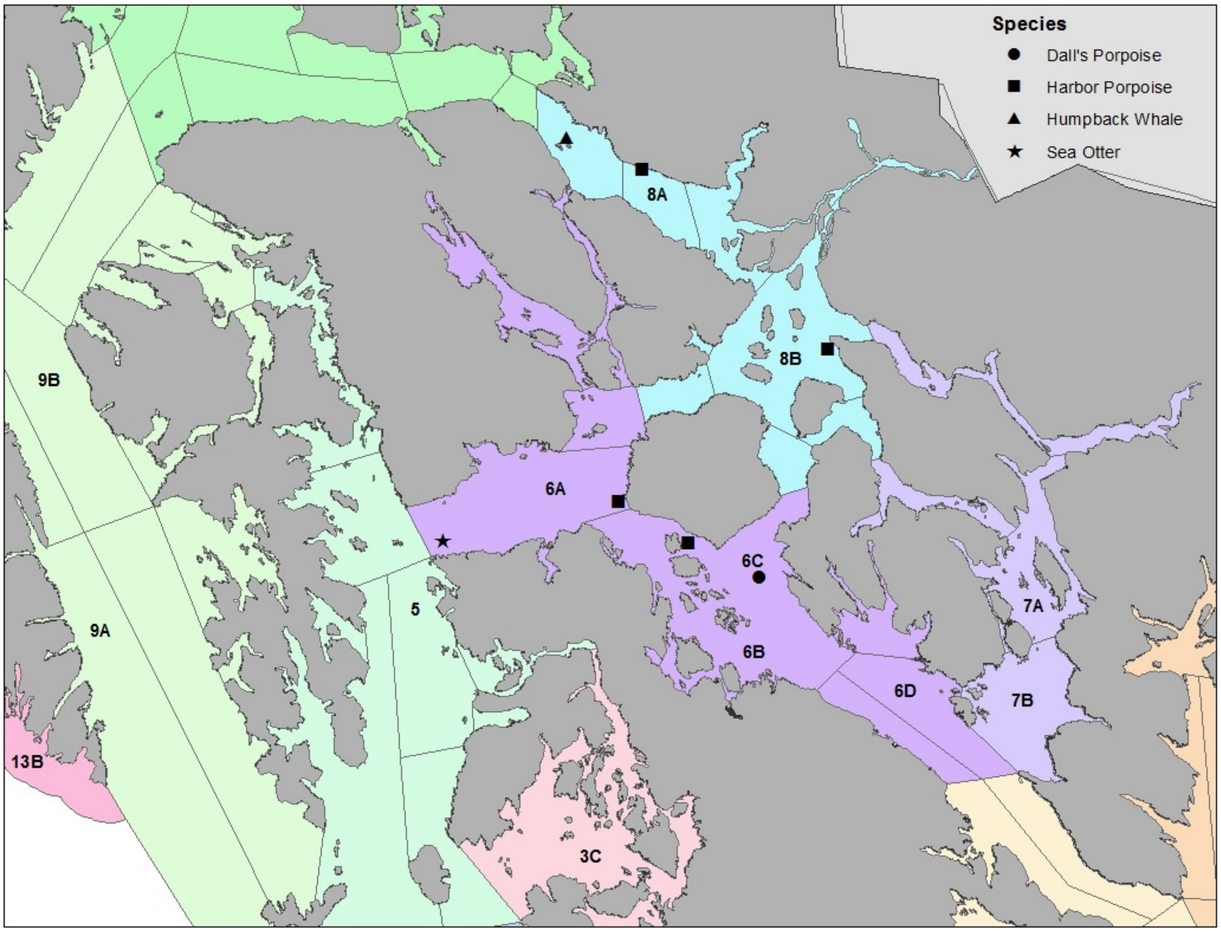

Figure 5.1 The location of marine mammal takes in 2012 and 2013.

Using the information provided in Table 4.1 with equations (5.1) and (5.2) the total takes can be estimated for live and dead common murres in subdistrict 6A and for Dall's porpoises in subdistrict 6B. As no takes were observed in other subdistricts the estimated total takes are zero for subdistricts 7A, 8A and 8B.

Table 5.1 shows the calculations of estimated take numbers in subdistricts 6A and 6B with bootstrap coefficients of variation and 95% confidence limits for the true total take numbers. In this case the coefficients of variation and confidence limits for common murres were calculated by resampling the data for the 116 observed trips where fishing started in subdistrict 6A with replacement 10,000 times. The coefficient of variation was then estimated as the standard deviation from the 10,000 bootstrap samples divided by the estimated total take, the lower confidence limit was the maximum of the observed take number and the value exceeded by 97.5% of the bootstrap estimated take numbers, and the upper limit was the value exceeded by 2.5% of the bootstrap estimated take numbers. Similarly, the bootstrap coefficient of variation and the percentile confidence limits for the Dall's porpoise total take estimate were calculated from bootstrap sampling of the data for the 76 observed trips in subdistrict 6B.

Table 5.1 Estimated total take numbers 2012 for common murres released alive and dead in subdistrict 6A and Dall's porpoises released alive but seriously injured in subdistrict 6B based on the total fishing effort times, the observed effort times in days and the observed take numbers. Bootstrapping, was used to calculate the coefficients of variation (CVs) and percentile confidence limits (CL) for the true total take numbers. There were no observed takes in subdistricts 7A, 8A or 8B.

Take	Subdistrict	Total Effort Days	Observed Effort Days	Take	Daily Take Rate	Estimated Total Take	% CV	Percentile Bootstrap CL Lower	Percentile Bootstrap CL Upper
Live Common Murre	6A	497.4	36.1	1	0.027	14	97.4	1	43
Dead Common Murre	6A	497.4	36.1	12	0.332	165	37.2	56	297
				13		179	35.1	58	326
Seriously injured Dall's Porpoise	6B	512.0	28.4	1	0.035	18	17.8	1	58

Estimated Total Takes in 2013

The number of takes and the species taken were much higher in 2013 than in 2012. Altogether there were 92 bird takes and six marine mammal takes. Table 5.2 shows the observed takes that were in all subdistricts except 8B. Based on the information in Table 4.2 on the observer coverage of the fishery in 2013 the total take numbers can be estimated as shown in Table 5.3. As for the 2012 results the bootstrap coefficients of variation and percentile confidence limits were calculated by bootstrap resampling of the results for observed trips 10,000 times, with each trip allocated to the subdistrict where the observed fishing began.

Table 5.2 The observed number of takes in 2013 of marine birds and mammals in subdistricts 6A, 6B, 7A and 8A, with no observed takes in subdistrict 8B.

Subdistrict	Live Common Murre	Dead Common Murre	Dead Marbled Murrelet	Dead Rhinoceros Auklet	Dead Cassin's Auklet	Dead Red Throated Loon	Harbor Porpoise	Sea Otter	Humpback Whale	Total
6A	2	70	1	3	1	1	1	1	0	80
6B	0	2	1	5	0	0	1	0	0	9
7A	0	0	1	0	0	0	0	0	0	1
8A	0	2	3	0	0	0	2	0	1	8
Total	2	74	6	8	1	1	4	1	1	98

Table 5.3 The take rates and total take numbers of marine birds and mammals estimated for subdistricts 6A, 6B, 7A and 8A in 2013, with bootstrap coefficients of variation (CV) and 95% percentile confidence limits (CL) for the true total take numbers (M/SI = mortality or seriously injured).

Species	Subdistrict		Total Effort Days	Observed Effort Days	Takes	Daily Take Rate	Estimated Total Takes*	% CV	Percentile Bootstrap CL Lower	Upper
Common Murre	6A	Live	810.3	54.6	2	0.037	30	70	2	76
	6A	Dead	810.3	54.6	70	1.282	1039	22	631	1523
	6B	Dead	733.9	43.7	2	0.046	34	69	2	86
	8A	Dead	323.7	28.7	2	0.070	23	69	2	57
					76		1124	21	711	1613
Marbled Murrelet	6A	Dead	810.3	54.6	1	0.018	15	99	1	46
	6B	Dead	733.9	43.7	1	0.023	17	99	1	53
	7A	Dead	219.9	17.4	1	0.058	13	100	1	40
	8A	Dead	323.7	28.7	3	0.104	34	73	4	90
					6		78	45	15	154
Rhinoceros Auklet	6A	Dead	810.3	54.6	3	0.055	45	56	3	101
	6B	Dead	733.9	43.7	5	0.114	84	52	16	179
					8		128	39	45	235
Cassin's Auklet	6A	Dead	810.3	54.6	1	0.018	15	99	1	47
Red Throated Loon	6A	Dead	810.3	54.6	1	0.018	15	100	1	47
Harbor Porpoise	6A	Live	810.3	54.6	1	0.018	15	99	1	47
	6B	Live	733.9	43.7	1	0.023	17	100	1	54
	8A	M/SI	323.7	28.7	2	0.070	23	68	2	56
					4		54	50	11	114
Sea Otter	6A	Live	810.3	54.6	1	0.018	15	100	1	47
Humpback Whale	8A	M/SI	323.7	28.7	1	0.035	11	99	1	36

*The estimated total takes for species in subdistricts and the sums of total takes for all subdistricts are rounded to integers. In some cases this results in the sums for all subdistricts differing slightly from the sums of the rounded integers. For example, for harbor porpoises the sum of the unrounded estimated total takes is 54 to the nearest integer but the sum of the rounded integers is 55.

6. Analysis of Variables and Factors Affecting Take Numbers

Table 6.1 shows the variables and factors that were considered as possibly being related to the take of marine birds or mammals where a variable is a measure of the environmental or sampling conditions such as the air temperature or the numbers of fishing hours observed, and a factor represents different conditions such as the state of the tide while fishing was observed.

Table 6.1 The variables and factors considered to possibly be related to the take of marine mammals and birds in 2012 and 2013. Each variable and factor value was for an observed fishing period with a net set, soak and haul so that one trip by an observer usually included several of these periods. Also, for some periods some of the variable or factor values were not recorded because they were not known, or for some other reason.

Day	A variable for the observation day number in the fishing season, with June 1 as day 1. In 2012 the maximum value for Day was 131, while in 2013 the maximum was 129.
Effort	A variable for the fishing effort involved in an observed set and haul. This is calculated as the set, soak and haul duration in hours multiplied by the proportion of the fishing period observed.
MTCode	the Midtime Code which is a factor that represents the time of day half way between the start of the set and the end of the haul being considered, from 0 to 24 hours. Because values close to 0 and 24 represent similar mid-fishing times the variable was classified for analysis purposes into the four classes: (1) midnight to 6am, (2) 6am to midday, (3) midday to 6pm, and (4) 6pm to midnight.
FZCode	A factor for the fishing zone: (0) unknown, (1) open water, (2) inside large bay, (3) inside sheltered bay, (4) river, (5) channel or canal (6) river mouth/estuary, (7) river mouth/open water, (8) creek or waterfall, or (9) other. An additional code (11) for a strait was only used in 2013.
Subdistrict	A factor for the fishing subdistrict: (1) 6A, (2) 6B, (3) 7A, (4) 8A or (5) 8B.
LDCode	A factor for the land code: (1) mainland shoreline, (2) peninsula or island (3) sand bar, (4) rocky reef, (5) submerged land, (6) prominent point, (7) more than one mile from shore, or (9) other.
AirTemp	A variable for the air temperature (°C).
WtrTemp	A variable for the water temperature (°C).
WtrClarity	Secchi depth in meters.
TDCode	A factor for the tide code: (1) ebb tide, (2) flood tide, (3) high slack, (4) low slack, or (9) other.
MSCode	The minimum distance to shore in meters was recorded but set at >1000 for distances greater than or equal to 1000 m. This variable was therefore changed to a factor with levels (1) <500 m, (2) 500 to <1000 m, and (3) 1000 m or more.
EndShp	A factor for the corkline shape at the end of a soak: (0) unknown, (1) straight, (2) 0 - 30° arc, (3) 31 - 60° arc, (4) 61 - 120° arc, (5) 121 -180° arc, (6) sinuous, (7) sudden submergence or diamond shape, or (9) other.
NVCode	A factor for the net view ranking: (1) clear view, (2) at least 1/3 view, (3) no underwater view, (4) distance/glare/obstruction, or (5) other.
HPump	A code for the use of a hydraulic pump: 0 = not used, 1 = used.

Note that the Effort variable is a measure of the amount of time that an observer watched a permit holder excluding times when the observer was not able to see the fishing for some reason. In general it is expected that a bird or mammal take is more likely to be observed when the Effort variable is high but this is not necessarily the case if, for example, the permit holder is not actively managing the net very early in the morning.

To examine any relationships between these variables and takes in 2012 and 2013, the take numbers for marine birds and mammals were first plotted against these variables and factor levels and then randomization tests were used to find any significant associations for cases where there are enough takes to carry out these tests. Because of the quite low take numbers in 2012 and much higher numbers in 2013 it is the second year that provides almost all of the information on the conditions that appear to be related to the probability of a take occurring.

Takes in 2012

In 2012 there were observed takes of 13 common murres and one Dall's porpoise, with 12 of the common murres dead and the Dall's porpoise released alive but seriously injured. Figure 6.1 shows the take numbers plotted against the variables and factors for that year. There were 1728 set, soak and haul periods observed, with most having the variable and factor values recorded. The most missing data is for water clarity, with only 1428 values recorded, presumably because this variable could not be measured for some reason.

For common murre takes it can be seen that takes tended to occur on later days (the number of days since July 1), with the observed effort less than four hours, with takes over 1 occurring with MTCode 2 (between 6am and noon), with FZCodes of 1 (open water) and 5 (channel or canal), all takes were in Subdistrict 1 (6A), all takes were with air temperatures below 13°C and water temperatures below 12°C, all takes were with water clarity depths between 2 and 8 meters, all takes of over one bird were with TDCode 2 (flood tide), all takes were 500 meters or more from the shore, takes occurred with all cork line shapes at the end of a soak except straight, all takes occurred with an NVCode of 3 (no underwater view), and no takes occurred while a hydraulic pump was used.

As there was only one marine mammal take in 2012 of a Dall's porpoise released alive but seriously injured the plots for this take are not very informative. Basically they just show what the conditions were when that one take occurred. For example it occurred in about the middle of the fishing season, with about three hours of observed fishing effort, with MTCode 3 (midday to 6pm), and so on.

The randomization tests considered were of two types. For variables the absolute mean difference between observed periods with and without common murre takes was calculated for the observed data and then the probability of obtaining this difference or more by chance was estimated by randomly assigning the nine observations with takes of common murres to the 510 observed fishing periods in subdistrict 6A, with 5,000 randomizations. Only data from this subdistrict was considered as there were no common murre takes in subdistricts 6B, 7A, 8A and 8B in 2012.

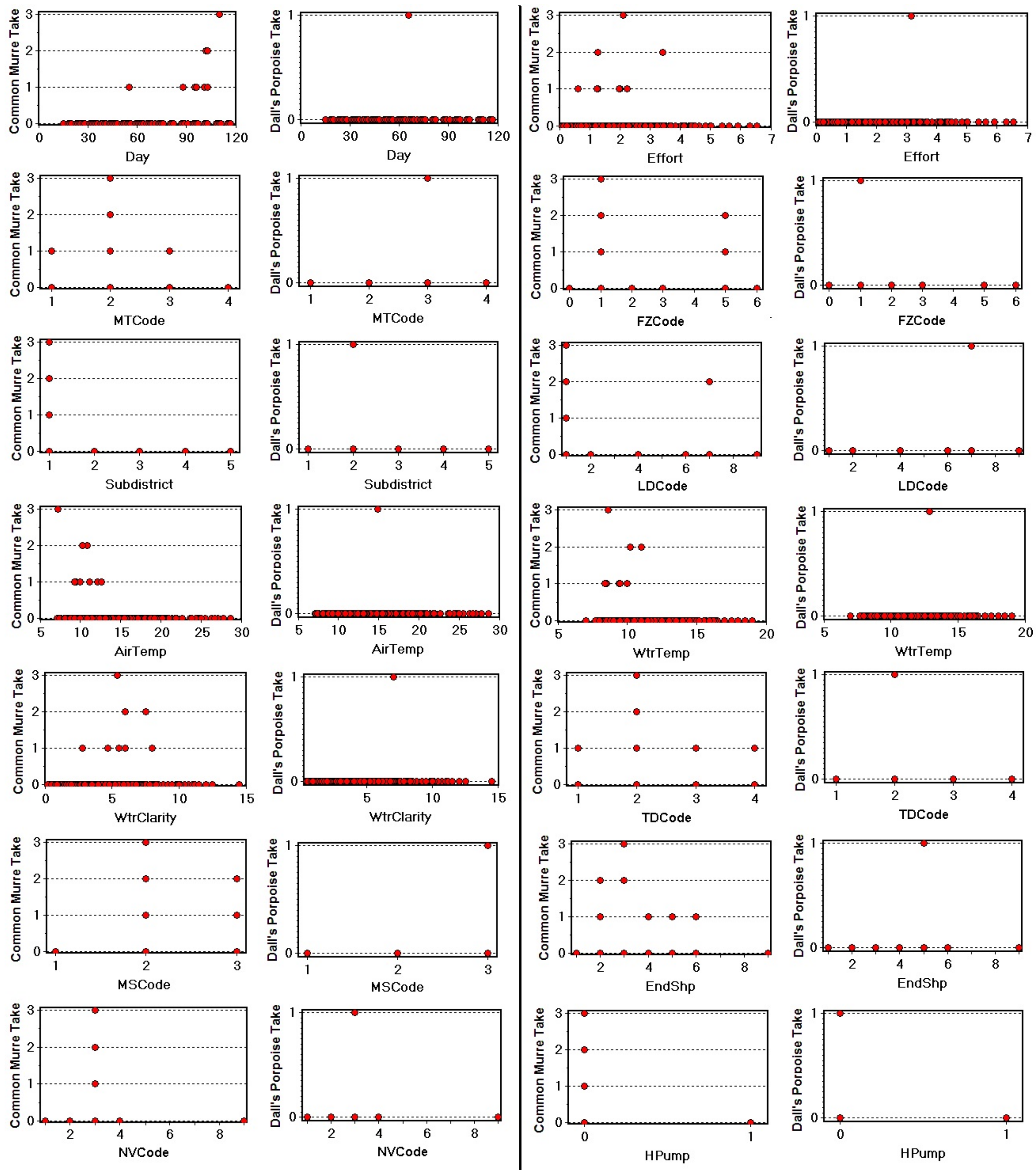

Figure 6.1 Take numbers plotted against variables and factors for 2012. The descriptions for the variables and factors are provided in Table 6.1.

For factors it was assumed that in the absence of any effects the take at a factor level is expected to be proportional to the number of observed fishing periods with that factor level. For example, if half the observed periods had factor level 1 then it is expected that half of the takes would be with that factor level. The test statistic used for randomization testing was therefore the sum of the chi-squared values of the form (Observed Take - Expected Take)^2/(Expected Take). The significance of the observed test statistic was then estimated by the proportion of values as large or larger for 5,000 randomized sets of data. Again only data for subdistrict 6A was used for the tests on factors.

The randomization tests provided the results shown in Table 6.2. The effect for the variable Day is significant at the 1% level and the effects for the factors MTCode (the mean observation time) and MSCode (the minimum distance from shore) are significant at the 5% level. In addition the effects for the Effort and AirTemp variables are nearly significant at the 5% level.

Table 6.2 The results from randomization tests for the relationships between takes of common murre in Subdistrict 6A in 2012 and the variable and factor values at the time of the observed fishing with P-values based on 5,000 randomized sets of data (* = significant at the 5% level, ** = significant at the 1% level).

Variable or Factor	P-value
Day	0.003**
Effort	0.078
MTCode	0.040*
FZCode	0.226
LDCode	0.491
AirTemp	0.065
WtrTemp	0.556
WtrClarity	0.377
TDCode	0.330
MSCode	0.013*
EndShp	0.367
NVCode	0.758
HPump	0.145

The effects of the significant variable and factors are illustrated further in Figure 6.2 which shows plots of the distribution of the Day variable for observations with none, one, two and three common murre takes and the takes per haul for the MTCode and MSCode factors. This figure shows that the mean observation day is lowest for hauls with no takes and increases with the number of takes, that the number of takes per observed period of fishing was highest for MTCodes 1 and 2 (midnight to 6am and 6am to noon), much lower for MTCode 3 (noon to 6pm), and zero for MTCode 4 (6pm to midnight), and that there were no takes with MSCode 1 (minimum shore distances of less than 500m), most takes per haul for MSCode 2 (minimum shore distances from 500 to less than 1000 m), and about one third as many takes per haul with MSCode 3 (minimum shore distances of 1000m or more).

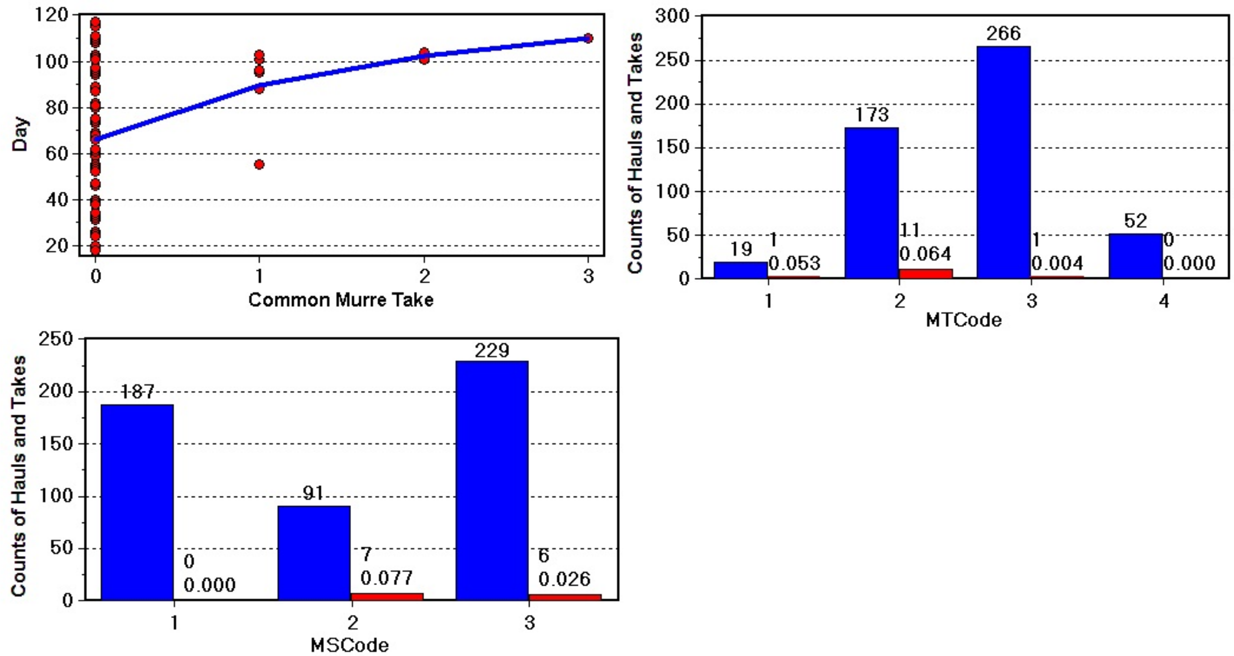

Figure 6.2 The distribution of the 2012 observation days with common murre takes of 0, 1, 2 or 3, and the number of observed hauls and takes for observations with MTCodes of 1 (midnight to 6am), 2 (6am to noon), 3 (noon to 6pm) or 4 (6pm to midnight) and MSCodes of 1 (mean shore distance less than 500m), 2 (minimum shore distance from 500m to less than 1000m) and 3 (minimum shore distance 1000m or more). For the plot of common murre takes against days the average day numbers are shown (—). The plots for MTCode and MSCode shows the number of observed hauls (■) with the count on the top and the number of takes of common murres (■) with the count and the number of takes per observation on the top. For example, for MTCode 1 there were 19 observed set to haul periods, with one common murre take, which is 0.053 takes per observed period.

Takes in 2013

In 2012 there were only 13 common murre takes, with one alive and 12 dead, and one seriously injured Dall's porpoise take (Table 5.1). The situation was very different in 2013 with 92 marine bird takes, with two alive and 88 dead, and six marine mammal takes (Table 5.2). Also in 2013 the bird takes were of six marbled murrelets, eight rhinoceros auklets, one Cassin's auklet and one red throated loon in addition to 76 common murres, while the marine mammal takes were of one sea otter, one humpback whale with serious injuries, and four harbor porpoises of which two were seriously injured.

To examine the possible relationship between take numbers and the 14 variables and factors described in Table 6.1 the take numbers were first plotted against these variables and factors, as shown in Figure 6.3. There were 2358 observed set, soak and haul periods in 2013, with variable and factor values recorded for most of these. As was the case in 2012 the most missing data values were for water clarity, with 150 missing values for the 2358 observed periods.

The plots in Figure 6.3 indicate that most takes were of common murres after day 50 (July 21), with less than five hours of observed fishing, with takes for all MTCodes (times at the middle of the observed periods), with FZCode 11 (fishing in a strait), in Subdistrict 1 (6A), with LDCodes 1, 2 and 7 (mainland shoreline, peninsula or island and more than one mile from shore), with air temperatures between 7 and 20°C, with water temperatures between 7 and 17°C, with water clarity from 4 to 10 meters, with all tide codes, not close to the shore, with all corkline end shapes except 1 (straight) and 9 (other), NVCodes of 2 and 3 (at least one third net view and no underwater view), and without a hydraulic pump operating.

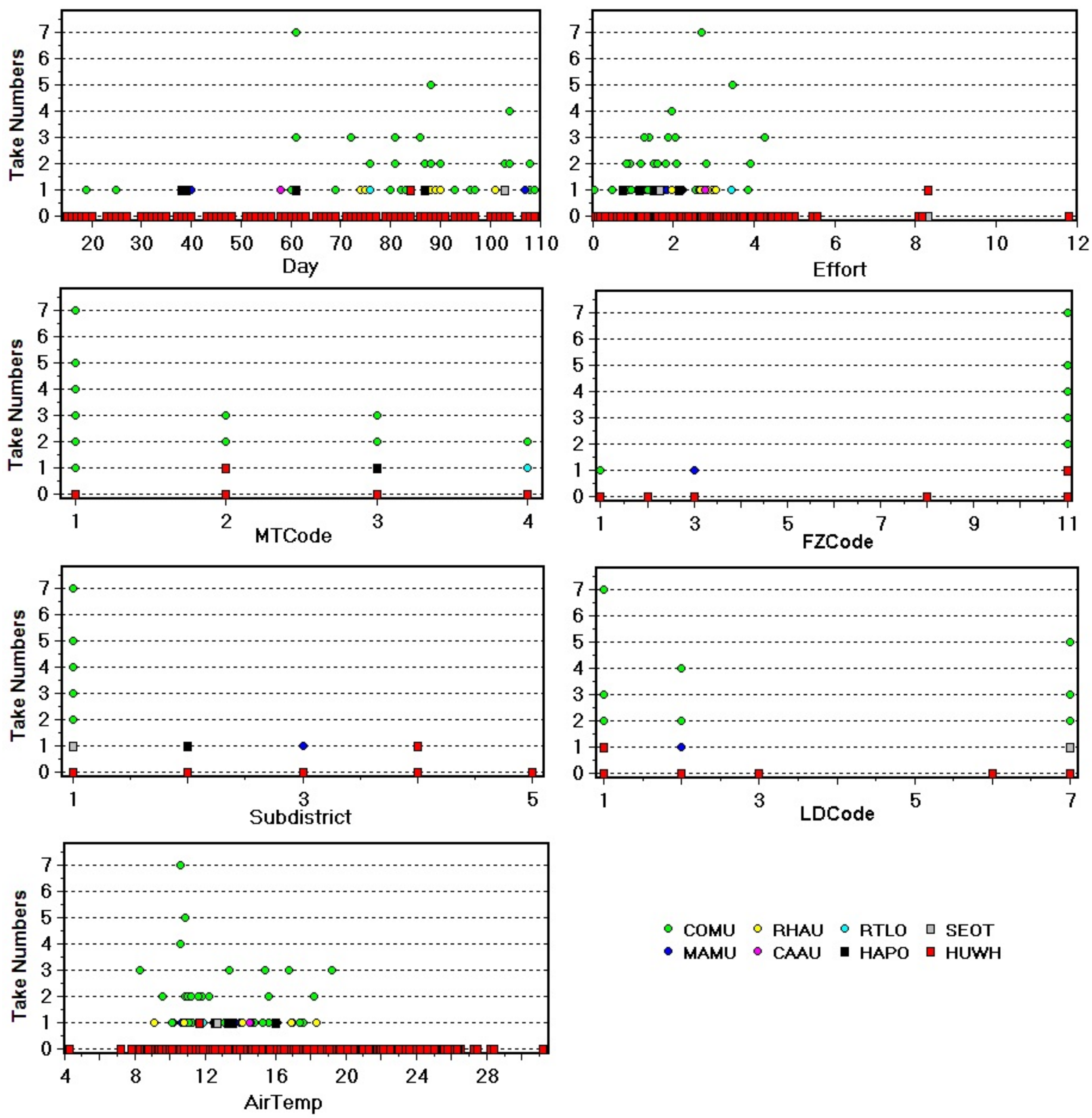

Figure 6.3 Take numbers plotted against variables and factors recorded for observed set, soak and haul periods in 2013. The short names for the species taken are COMU (common murre), MAMU (marbled murrelet), RHAU (rhinoceros auklet), CAAU (Cassin's auklet), RTLO (red throated loon), HAPO (harbor porpoise), SEOT (sea otter) and HUWH (humpback whale).

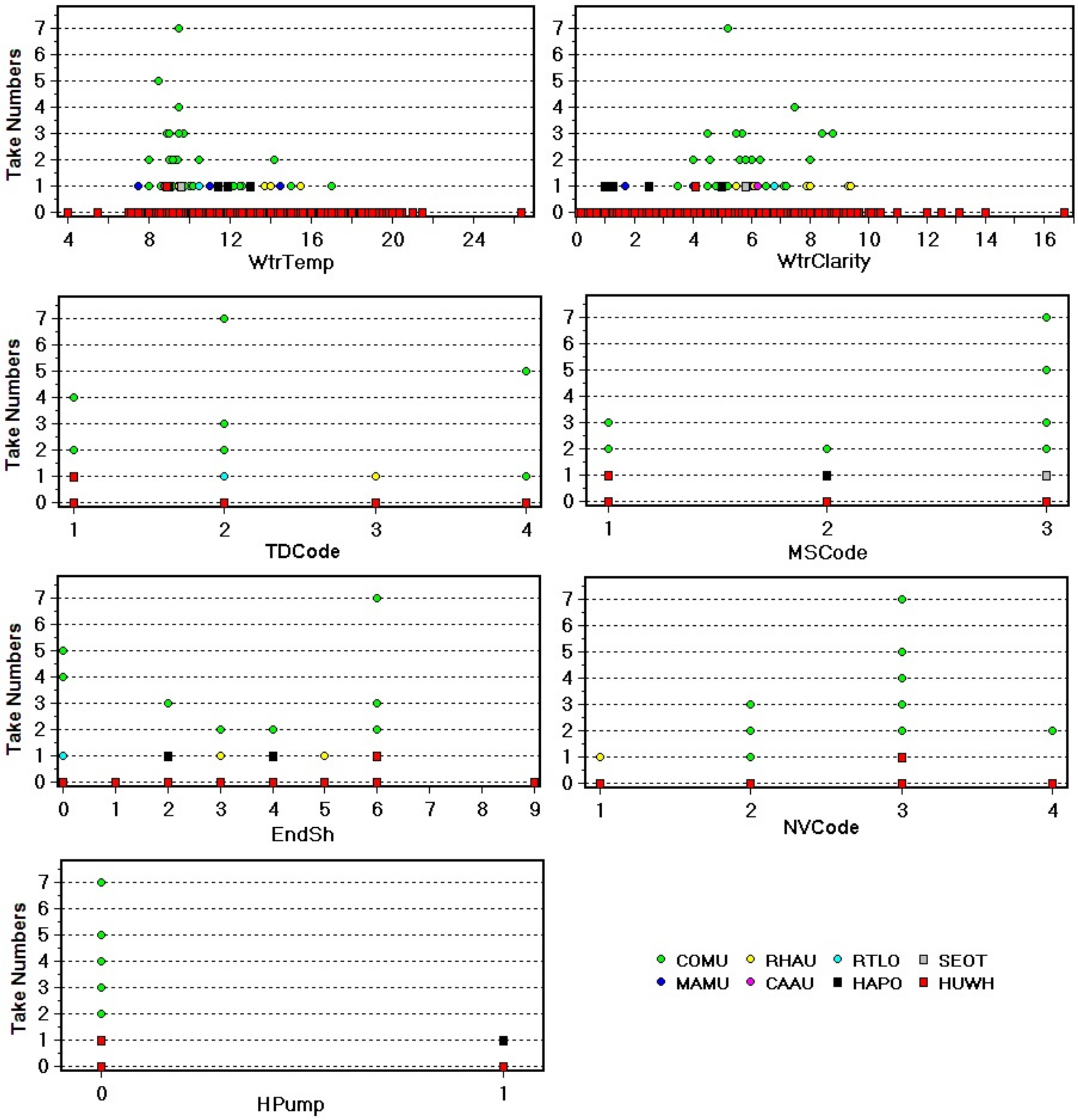

Figure 6.3, Continued

The next stage in the analysis was to use randomization tests to see which of the 14 variables and factors defined in Table 6.1 are significantly related to the take numbers observed for individual set, soak and haul periods. Because of the low takes of most species these analyses were carried out with the dependent variables being the take numbers of all common murre (alive and dead), the take numbers for all birds species (common murre + marbled murrelet + rhinoceros auklet + Cassin's auklet + red throated loon), and the take numbers for all marine mammals. Also, because there were no takes of marine birds or mammals in subdistrict 5 (8B) no data from this subdistrict were included in the analyses. In addition, because there were no common murre or marine mammal takes in subdistrict 7A the common murre and marine mammal tests were carried out only using the data from subdistricts 6A, 6B and 8A.

As was done for the 2012 data, the significance of the variable effects was assessed by finding the means for the observations with takes and the observations without takes. The absolute mean difference was then the tests statistic and the significance level (the probability of obtaining a difference as large as the observed difference by chance) was estimated using 5,000 randomized sets of data with the takes randomly assigned to the observed data sets. Similarly the significance of the factor effects was assessed using chi-squared test statistics as described above for the 2012 data, again with 5,000 randomizations.

Table 6.3 gives the results obtained from the randomization tests. For all common murre there are effects that are significant at the 5% level at least for the variables day, air temperature, water temperature and water clarity. For the factors the effects are significant at the 5% level at least for the midtime code, the subdistrict, the land code, the minimum shore distance code and the hydraulic pump.

To make these common murre effects clearer Figure 6.4 shows plots of the distributions of the variables with significant effects against the number of common murre takes in each observed fishing period, and plots of the number of hauls and takes per observed period against the factor levels. This figure shows that common murre takes tended to occur later in the fishing season, when temperatures were lower, and with moderate water clarity. Also for the factors, based on the number of takes per observed time period, the takes tended to occur with midtime code 1 (midnight to 6am), in subdistrict 1 (6A), with land code 7 (more than one mile from shore), with minimum shore distance code 3 (more than 1000 meters from shore), and without a hydraulic pump operating.

Table 6.3 The results of randomization tests on the effects of individual variables and factors on the number of common murre takes, all marine bird takes and all marine mammal takes in observed set, soak and haul periods in 2013. The common murre and marine mammal tests were carried out using data from Subdistricts 6A, 6B and 8A, where takes occurred. For all bird species data from Subdistrict 7A were also used as there was one bird take in that subdistrict. The P-values are based on 5,000 randomized sets of data (* = significant at 5% level, ** = significant at the 1% level, *** = significant at the 0.1% level).

	Common Murre	All Birds	Marine Mammals
Variable or Factor	P-value	P-value	P-value
Day	0.000***	0.000***	0.983
Effort	0.954	0.051	0.018*
Midtime Code (MTCode)	0.000***	0.000***	0.339
Fishing zone code (FZCode)	0.088	0.087	1.000
Subdistrict	0.000***	0.000***	0.292
Land code (LDCode)	0.011*	0.003**	0.685
Air Temperature	0.003**	0.000***	0.373
Water Temperature	0.000***	0.000***	0.289
Water Clarity	0.008**	0.000***	0.037*
Tide Code (TDCode)	0.183	0.271	0.026*
Minimum Shore Distance Code (MSCode)	0.002**	0.000***	0.506
End Shape Code (EndShp)	0.380	0.176	0.258
Net View Code (NVCode)	0.315	0.395	1.000
Hydraulic Pump (HPump)	0.034*	0.005**	1.000

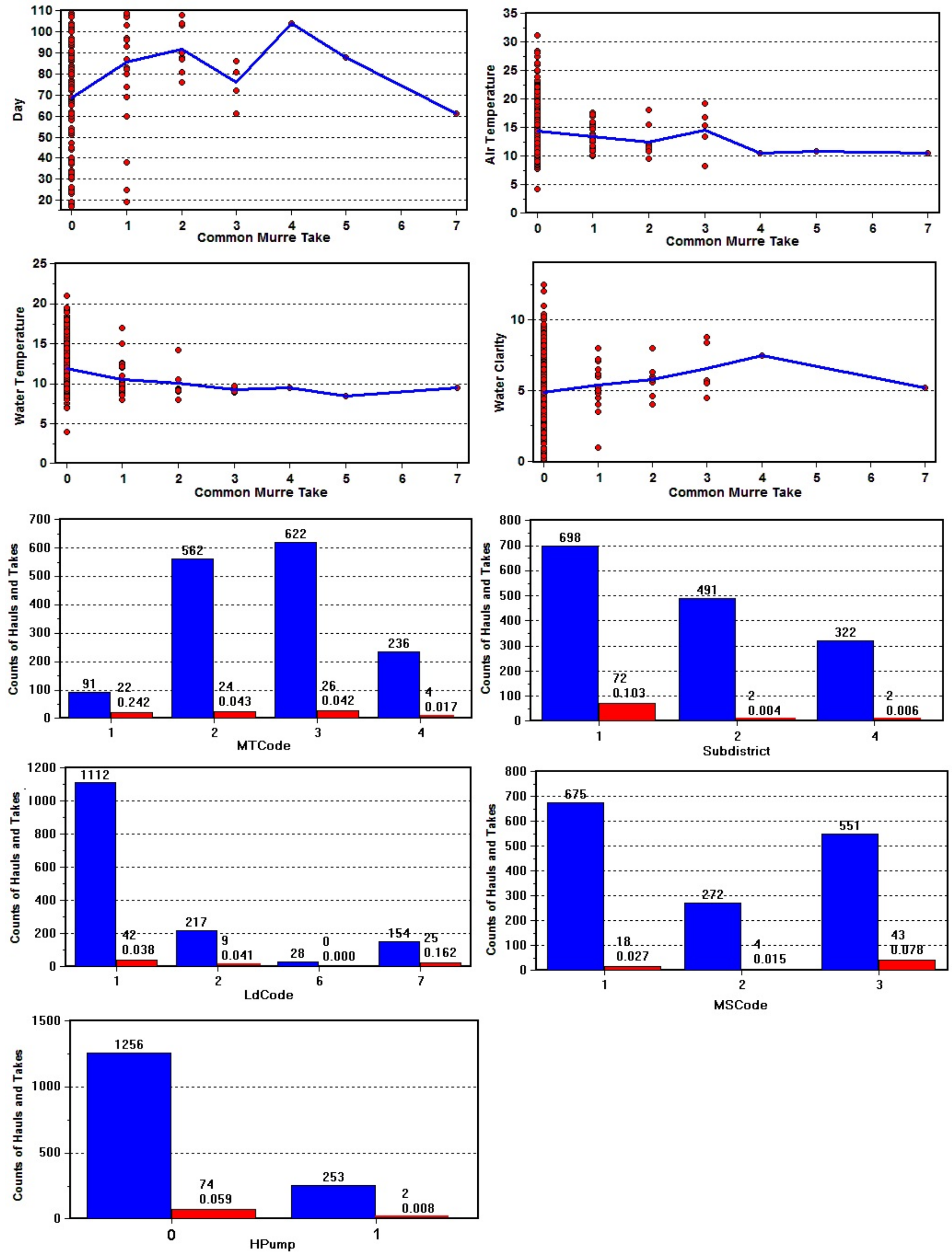

Figure 6.4 The 2013 distribution of variables plotted against the common murre takes for variables significantly related to the take numbers and the number of observed set, soak and haul periods (■), the number of takes (■) and the number of takes per observed period for factors significantly related to the number of common murre takes. For example with MTCode 1 (midnight to 6am) there were 91 hauls and 22 takes so that the number of takes per haul was 22/91 = 0.242. Average variable values are also shown (—).

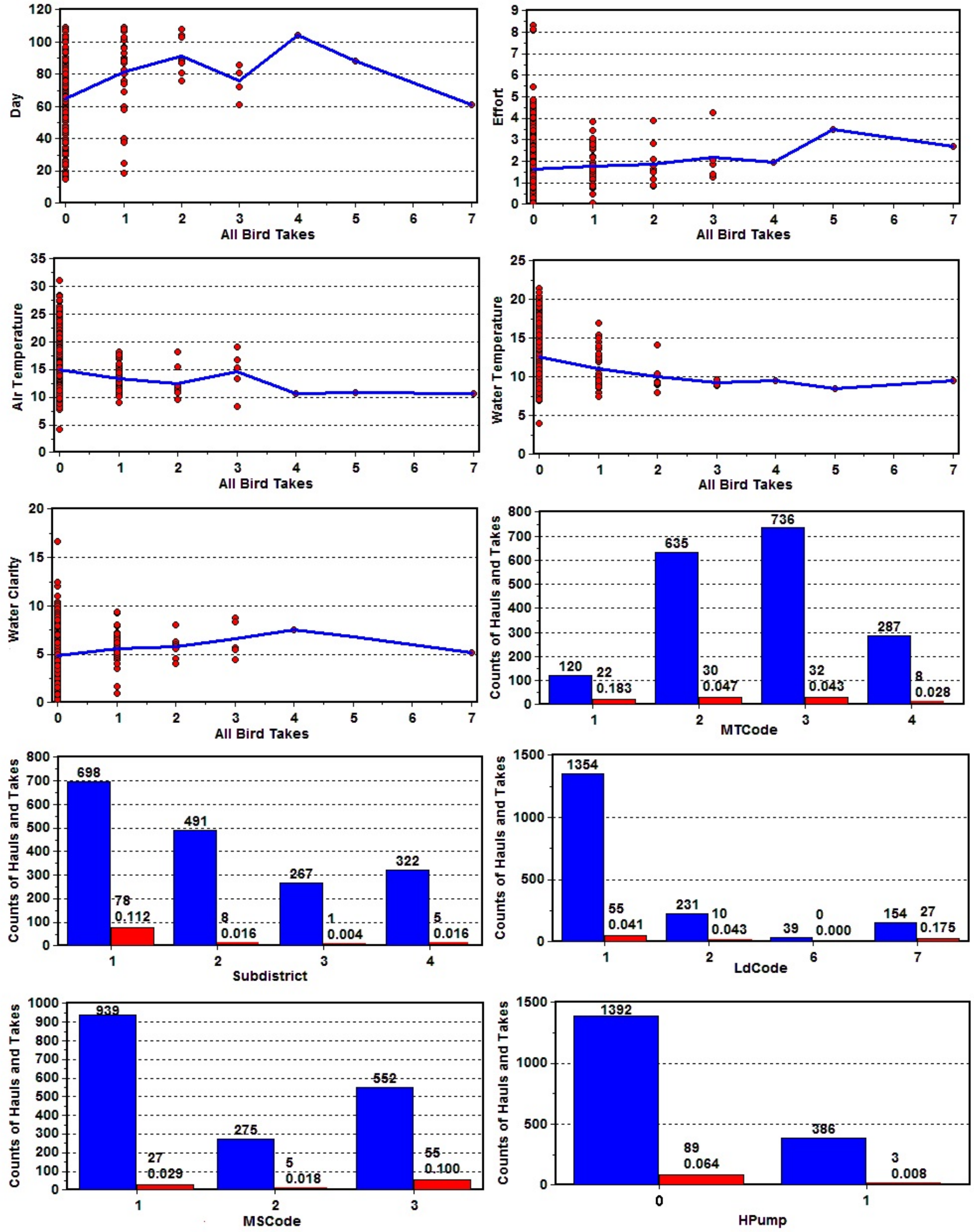

Figure 6.5 The 2013 distribution of variables plotted against the takes for all birds for variables significantly related to the take numbers. For factors the number of observed set, soak and haul periods (■), the number of takes (■) are plotted against the factor levels with the nuber of observations, the number of takes and the number of takes per observed period shown. For example with MTCode 1 (midnight to 6am) there were 120 hauls and 22 takes so that the number of takes per haul was 22/120 = 0.183. Average variable values are also shown (—).

Figure 6.5 illustrates the effects that are significant or nearly significant at the 5% level for all birds, for which the results in Table 6.3 are generally similar to those for common murre alone. The exception is for the Effort variable which is far from significant for common murres but very nearly significant at the 5% level for all birds.

For marine mammals the results are only significant at the 5% level for the Effort and Water Clarity variables and the tide code factor. This is because for five of the six mammal takes the Effort variable was less than 2.5 hours and for one take the effort was 8.3 hours, the water clarity was low for all takes, and all takes had the Tide Code 1 (ebb tide). Figure 6.6 illustrates these effects further.

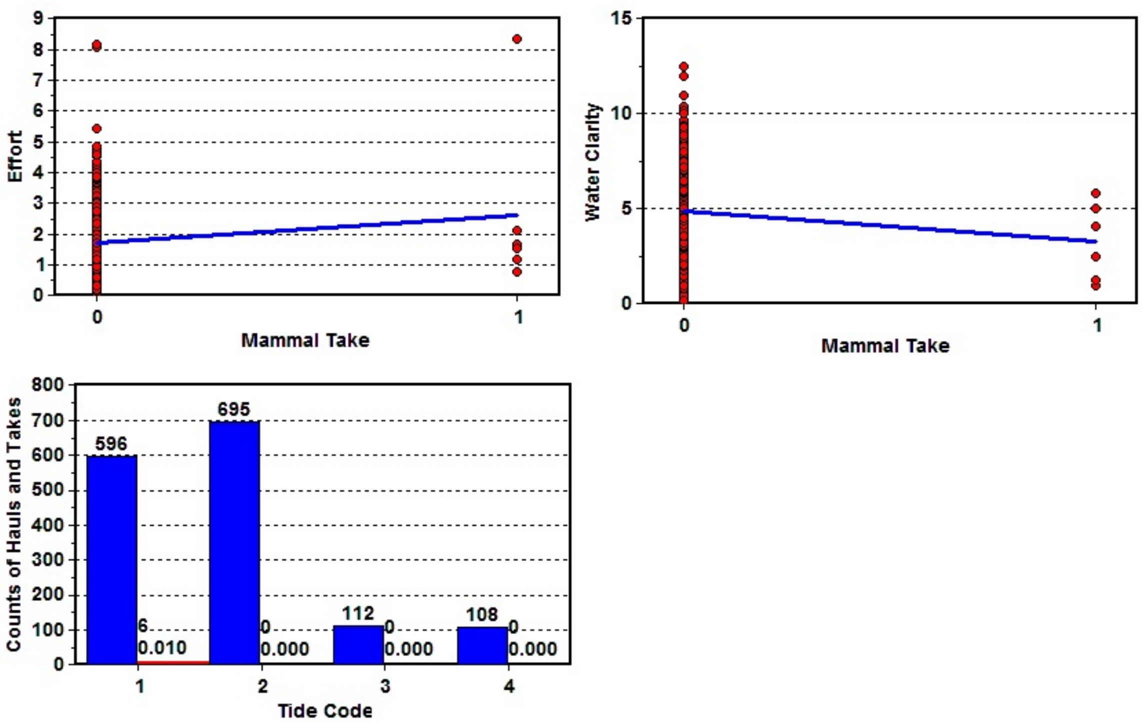

Figure 6.6 The 2013 distribution of the observed effort in hours and the water clarity in meters plotted against the marine mammal takes of 0 or 1 and the counts of hauls and takes plotted against the tide codes. For the tide code factor the number of observed set, soak and haul periods (■), the number of takes (■) are plotted against the factor levels with the number of observations, the number of takes and the number of takes per observed period shown. For example with tide code 1 (ebb tide) there were 596 hauls and 6 takes so that the number of takes per haul was 6/596 = 0.010. There were no takes for the other tide codes (flood tide, high slack and low slack). Average variable values are also shown (—).

Year Differences in Variables and Factors

An obvious question is why there were so many more marine bird and mammal takes in 2013 than in 2012. Part of the reason is that pink and coho salmon runs were much higher in 2013 than in 2012. This resulted in more boats fishing in July and August and more open days in districts 6 and 8 in 2013 than in 2012. As a result the number of observed periods was higher in 2013 than in 2012. However this is only part of the difference because, for example, the total observed bird take from all 1728 observed set, soak and haul periods in 2012 was 13, giving an average take of 13/1728 = 0.0075 takes per observed period, while in 2013 there were 2358 observed periods with 92 bird takes, giving an average of 92/2358 = 0.0390 takes per observed period. Overall, therefore, the bird take per observed period was about five times higher in 2013 than it was in 2012.

Another possibility is that the higher take rate in 2013 was due to differences in the distribution of variables or factors that account for the environmental condition while fishing was observed in the two years. Because of the low number of bird takes in 2012, that were only in Subdistrict 6A, the only variables and factors significantly related to the takes for that year are the day in the fishing season, the midtime code, and the minimum distance to the shore code. As shown in Figure 6.2, the results for these variables and factors suggest that the probability of a take tended to be higher later in the fishing season with Midtime Codes 1 and 2 (fishing with a mean time from midnight to 6am or 6am to noon), and with a minimum shore distance code of 2 (from 500 to 1000 meters from shore). Also, of course, there is evidence that the probability of a take was much higher in subregion 6A than in other subregions as all observed takes were in subregion 6A.

These effects are also seen in the results for common murre takes and all bird takes in 2013, as shown in Figures 6.4 and 6.5. However, because of the much higher take numbers in 2013 there are also significant effects in that year for other variables and factors. For example for common murre in 2013 the probability of a take also tended to increase with lower temperatures and higher water clarity, and had the highest observed take rate with Land Code 7 (more than one mile from shore) and with a hydraulic pump not being used.

One way to compare the years is in terms of differences between the mean variable values. Randomization tests were considered for this with the significance of the absolute difference between the two years assessed by the proportion of absolute differences that large or larger for 5000 randomized sets of data, with the 1728 observations in 2012 and the 2358 observations in 2013 randomly assigned to the two years. This gives the results in Table 6.4 which show that the average observation day in 2013 was significantly later at the 5% level than the average in 2012, that there was no significant difference in the average observed hours of effort, and that the air temperature, water temperature and water clarity were all highly significantly lower in 2012 than in 2013.

Randomization tests were also used to compare the factor levels observed in 2012 and 2013. For this purpose the test statistics used were the usual chi-squared values used to compare two samples where the counts are available for two or more levels of a factor. The significance of the observed chi-squared values were then assessed by the proportion of randomized sets of data giving the observed values or higher values. The randomization again involved randomly allocating the 1728 observations in 2012 and the 2358 observations in 2013 to the two years. The fishing zone code was not included in the testing because the code 11 was added in 2013 and most of the fishing in that year was assigned that code.

Table 6.4 The significance of the difference in variable means for 2012 and 2013 based on 5000 sets of data with the 1728 observations from 2012 and the 2358 observations for 2013 randomly assigned to the two years (* significance at 5% level, *** significance at 0.1% level).

Year	Day	Effort	Temperature Air	Temperature Water	Water Clarity
2012	60.7	1.54	13.24	11.67	3.58
2013	62.9	1.56	15.32	12.92	4.36
Difference	2.14	0.02	2.08	1.25	0.78
P-value	0.015*	0.535	0.000***	0.000***	0.000***

The results from the randomization tests are shown in Table 6.5. The difference in the distribution of factor levels is significant at the 5% level of more for all of the factors. It is therefore clear that the observed fishing conditions were quite different in 2012 and 2013.

Given the evidence that the values of variables and factor were generally quite different in 2012 and 2013, this raises the question of whether some of these differences may account for the much lower take numbers in 2012 than in 2013. One way to examine this involves using the 2013 data to estimate a model that attempts to account for the observed take numbers in that year as a function of the variables and factors during observation periods. Applying that model to the 2012 data would then show whether the low number of takes in 2012 is accounted for by the variable and factor conditions in that year. For example, if a model for all bird takes based on the 2013 data predicts that there would only have been about 13 takes in 2012 then clearly there is evidence that the low take in 2012 was due to the environmental and fishing conditions in that year. As there was limited data on marine mammal takes in 2013, with only six takes, the modeling approach was not attempted with that data.

To model the take for all birds in 2013 as a function of the variables and factors during observation periods in that year the significant or nearly significant variables and factors shown in Table 6.3 for all birds were initially considered as there is evidence that the bird take is related to these. However the water clarity variable was not used for modeling because this had more missing data then any of the other variables. The variables and factors initially considered were therefore the day, effort, midtime Code, subdistrict, land code, air temperature, water temperature, minimum shore distance code, and the hydraulic pump code. The data on these variables and factors was used to model the take for all birds for the observed periods as a log-linear model of the form

$$\text{Expected Take} = \text{Exp}(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots \beta_p X_p)$$

where the β values are estimated parameters and the variables X_1 to X_p account for the effects of the variables and factors.

Table 6.5 The results of chi-squared randomization tests to compare the distribution of factor levels in 2012 and 2013. The observed chi-squared statistics calculated in the standard way are shown, with the P-value being the proportion of values that large or larger for 5000 sets of data with the observations randomly assigned to the two years. The significance of the P-values is also shown (* significance at the 5% level, ** significance at the 1% level, *** significance at the 0.1% level).

Midtime Code

	1	2	3	4	Total		
2012	97	624	783	224	1728		
2013	167	852	965	374	2358	Chi-squared	P-value
Total	264	1476	1748	598	4086	13.5	0.004**

Subdistrict Code

	1	2	3	4	5	Total		
2012	510	304	199	138	576	1727		
2013	698	491	267	322	580	2358	Chi-squared	P-value
Total	1208	795	466	460	1156	4085	60.8	0.000***

Land Code

	1	2	3	4	6	7	9	Total		
2012	1108	158	0	10	286	165	1	1728		
2013	1829	299	1	0	70	159	0	2358	Chi-squared	P-value
Total	2937	457	1	10	356	324	1	4086	273.0	0.000***

Tide Code

	1	2	3	4	Total		
2012	654	777	147	150	1728		
2013	955	1086	159	158	2358	Chi-squared	P-value
Total	1609	1863	306	308	4086	11.4	0.011*

Minimum Shore Distance Code

	1	2	3	Total		
2012	1147	245	328	1720		
2013	1458	307	581	2346	Chi-squared	P-value
Total	2605	552	909	4066	18.6	0.000***

End Shape Code

	1	2	3	4	5	6	9	Total		
2012	50	178	234	247	157	760	10	1636		
2013	84	215	197	187	269	1301	3	2256	Chi-squared	P-value
Total	134	393	431	434	426	2061	13	3892	102.6	0.000***

Net View Code

	1	2	3	4	9	Total		
2012	14	60	1613	40	1	1728		
2013	10	92	2233	23	0	2358	Chi-squared	P-value
Total	24	152	3846	63	1	4086	16.2	0001***

Heat Pump

	0	1	Total		
2012	1195	533	1728		
2013	1713	639	2352	Chi-squared	P-value
Total	2908	1172	4080	6.6	0.011*

Note that the factor codes are as follows in order: Midtime (midnight to 6 am, 6 am to noon, noon to 6 pm and 6 pm to midnight); Subdistrict (6A, 6B, 7A, 8A and 8B); Land (mainland shoreline, peninsula or island, sand bar, rocky reef, submerged land, prominent point, more than 1 mile from shore and other); Tide (ebb tide, flood tide, high slack, low slack and other); Minimum Shore Distance (< 500 m, 500 to < 1000 m and 1000 m or more); End Shape (straight, 0 to 30° arc, 31 to 60° arc, 61 to 120° arc, sinuous, sudden submergence or diamond shape and other); Net View (clear, at least 1/3 view, no underwater view, distance/glare/obstruction and other); and Heat Pump (not used and used).

The data are the same as used for the earlier analyses described above except that in order to get as much as possible data on take numbers any missing variable or factor values for an observed set, soak and haul period were replaced where possible using the values for earlier and/or later observed periods with the same permit holder. For example, the air temperature was sometimes missing for an observed period but had been recorded for the previous period and the following period. The missing air temperature was then set equal to the average for the previous and following periods. This was done for both the 2012 and 2013 data sets. It resulted in there being 1151 observed periods in subdistricts 6A, 6B, 7A and 8A in 2012 and 1778 observed periods in these subdistricts in 2013. No data from subdistrict 8B was considered because of the lack of any takes in that subdistrict in either year.

The log-linear model for the 2013 data was fitted by standard quasi-maximum likelihood, with 5000 bootstrap resamples of the observations to estimated the standard errors and significance levels of the estimated coefficients. First the model including all of the variables and factors day, effort, midtime code, subdistrict, land code, air temperature, water temperature, minimum shore distance code, and the hydraulic pump code was fitted. This model accounts for 30.6% of the variation in take numbers based on the dispersion (a measure analogous to the residual sum of squares in ordinary linear regression), with 17 estimated parameters.

After fitting the initial model non-significant variables and factors were removed sequentially until only significant effects remained in the model. The final model then included the variables day and effort and the factors for the midtime code, the subdistrict, and the land code, as shown in Table 6.6. This accounts for 28.8% of the variation in take numbers with 12 estimated parameters. The zero estimated values of factor parameters represent the standard which other factor levels are compared to. Negative estimates for other factor levels mean that the predicted take numbers are lower than those for the standard factor level while the positive estimated coefficients for the variables Day and effort indicate that the predicted take increases with values of these variables. Overall therefore the model predicts the highest takes at later days in the fishing season, with high observed effort hours, with midtime Code 1 (midnight to 6 am), in subregion 6A, and with land Code 7 (more than one mile from shore).

The midtime code effect is particularly interesting because late in 2012 it was thought that there may have been some under-sampling of the fishing early in the morning. As a result, in 2013 the logistics, planning and tracking of fishing effort were improved to avoid any under-sampling of early mornings. As a result 5.6% of the observed periods in 2012 were with a midtime from midnight to 6 am but this increased to 7.1% in 2013. There may therefore have be a small negative bias in the estimation of the number of early morning takes of birds in 2012.

When the estimated model from Table 6.6 is used to estimate the take of all birds for the 1151 observed periods in subdistricts 6A, 6B, 7A and 8A in 2012 it gives a total expected take of 57.6 birds. As the total observed take was only 13 birds this shows that the much lower take in 2012 than in 2013 is not accounted for by the different fishing conditions in the two years.

Table 6.6 The final estimated model for the number of takes of all birds in Subregions 6A, 6B, 7a and 8A in Southeast Alaska in 2013. The standard errors and the significance of the parameters (P-values) are estimated from 5000 bootstrap resamples of the results for the 1778 observed set, soak and haul periods. The first level of all factors is set at zero and represents a standard level for the model, with no standard error or P-value.

Parameter	Estimate	Standard Error	P-value
Constant	-3.288	1.090	-
Day	0.026	0.005	0.000
Effort	0.394	0.100	0.000
Midtime Code 1	0.000	-	-
Midtime Code 2	-1.853	0.974	0.000
Midtime Code 3	-1.897	0.969	0.000
Midtime Code 4	-2.002	1.126	0.000
Subregion 1 (6A)	0.000	-	-
Subregion 2 (6B)	-2.338	0.672	0.000
Subregion 3 (7A)	-2.907	5.159	0.604
Subregion 4 (8A)	-2.008	1.190	0.002
Land Code 1	0.000	-	-
Land Code 2	-0.249	0.915	0.617
Land Code 6	-8.394	2.936	0.000
Land Code 7	0.681	0.337	0.032

7. Estimated Total Blow-Through Numbers

Apart from the fisheries take of marine mammals and birds there is also interest in the occurrence of net blow-throughs by marine mammals. This occurs when a net is in the water and a marine mammal makes a hole in the net and passes through. Then when the net is pulled from the water the hole can be seen although the marine mammal may have disappeared. Blow-throughs are thought to be made mainly by whales and Steller sea lions, with most of them being done by humpback whales.

In 2012 there were three observed blow-throughs, with two in subdistrict 6A and one in subdistrict 6B. Ratio estimation can then be used to estimate the total number of blow-throughs in these two subdistricts using equations (5.1) and (5.2) in the same way that was used to estimate total bird and marine mammal takes. This then provides the results shown in Table 7.1.

Table 7.1 Estimated total number of net blow-throughs in subdistricts 6A and 6B in 2012 based on the total fishing effort times, the observed effort times in days and the observed blow-through numbers. Bootstrapping, was used to calculate the coefficients of variation (CVs) and 95% confidence limits (CL) for the true total take numbers as described in Section 5 of this report. There were no observed blow-throughs in subdistricts 7A, 8A or 8B.

	Total	Observed			Estimated		Percentile	
					Total			
	Effort	Effort	Blow-	Daily	Blow-	%	Bootstrap CL	
Subdistrict	Days	Days	Throughs	Rate	Throughs	CV	Lower	Upper
6A	497.4	36.1	2	0.055	28	70.1	2	71
6B	512.0	28.4	1	0.035	18	97.9	1	56
			3		46	57.1	3	103

In 2013 there also three blow-throughs, again with two in subregion 6A and one in subregion 6B. Using the same calculations as used for Table 7.1 then produced the total estimated number of blow-throughs in 2013 that are shown in Table 7.2.

Table 7.2 Estimated total number of net blow-throughs in subdistricts 6A and 6B in 2013 based on the total fishing effort times, the observed effort times in days and the observed blow-through numbers. Bootstrapping, was used to calculate the coefficients of variation (CVs) and 95% confidence limits (CL) for the true total take numbers as described in Section 5 of this report. There were no observed blow-throughs in subdistricts 7A, 8A or 8B.

	Total	Observed			Estimated		Percentile	
					Total			
	Effort	Effort	Blow-	Daily	Blow-	%	Bootstrap CL	
Subdistrict	Days	Days	Throughs	Rate	Throughs	CV	Lower	Upper
6A	810.3	54.6	2	0.037	30	70.7	2	77
6B	733.9	43.7	1	0.023	17	99.6	1	53
			3		47	57.3	3	106

8. Discussion

The AMMOP was set up in 1990 to gather information about serious injuries and mortalities of marine mammals from takes during commercial fishing operations in Alaska, with the gathering of data on serious injuries and mortalities from takes of marine birds being an important secondary benefit from the program. The observing in 2012 and 2013 was therefore intended to obtain information on marine mammal and bird takes from drift gillnet fishing for two years in districts 6, 7 and 8 in Southeast Alaska, with the drift gillnet fishing in other districts in Southeast Alaska planned to be observed in later years.

The Sampling Plan and Estimated Marine Mammal and Bird Takes

The plan in 2012 was to observe 7.5% of the drift gillnet fishing in districts 6, 7 and 8. In practice the observed percentage of the fishing was 6.4%, which is slightly less than what was planned. This resulted in one seriously injured Dall's porpoise take being observed, and 13 common murre takes being observed with only one common murre released alive. Based on the observed takes and the subdistricts where these occurred it is estimated that in 2012 the total number of Dall's porpoise takes with serious injuries was 18 with a 95% confidence interval of 1 to 58, the total number of common murre takes with a live release was 14 with a 95% confidence interval of 1 to 43, and the total number of common murre takes with a dead release was 165 with a 95% confidence interval of 56 to 297, with common murre takes only in fishing subdistrict 6A and Dall's porpoise takes only in fishing subdistrict 6B (Table 5.1).

The plan was also to observe 7.5% of the drift gillnet fishing in districts 6, 7 and 8 in 2013. Again the observed percentage of the fishing was 6.6%, which is slightly less than what was planned. The fishing conditions were not similar in 2012 and 2013. In 2013 the pink and coho salmon runs were much higher than in 2012 resulting in many more open days and many more boats fishing in 2013, and therefore more fishing days observed. The observed take of marine mammals and birds was also much higher in 2013 than in 2012 with six mammal takes (four harbor porpoises with two seriously injured, one sea otter and one humpback whale seriously injured), two common murre takes with live releases and 90 other bird takes with dead releases (74 common murres, six marbled murrelets, eight rhinocerus auklets, one Cassin's auklet and one red throated loon).

The mammal takes were in subdistricts 6A, 6B and 8A while the bird takes were in those subdistricts and also in subdistrict 7A. Taking these subdistricts into account it is estimated that the total take of live and dead common murres in subdistricts 6A, 6B and 8A in 2013 was 1124 with a 95% confidence interval of 711 to 1613, the total take of dead marbled murrelets in subdistricts 6A, 6B, 7A and 8A was 78 with a 95% confidence interval of 15 to 154, the total take of dead rhinocerus auklets in subdistricts 6A and 6B was 128 with a 95% confidence interval of 45 to 235, the total take of dead Cassin's auklets subdistrict 6A was 15 with a 95% confidence interval of 1 to 47, the total take of red throated loons in subdistrict 6A was also 15 with a 95% confidence interval of 1 to 47, the total take of live and seriously injured harbor porpoises in subdistricts 6A, 6B and 8A was 54 with a 95% confidence interval of 11 to 114, the total take of live sea otters in subdistrict 6A was 15 with a 95% confidence interval of 1 to 47, and the total take of seriously injured humpback whales in subdistrict 8A was 11 with a 95% confidence interval of 1 to 36 (Table 5.3).

Variables and Factors Related to Take Numbers

There are 14 variables and factors recorded by observers that were considered as possibly related to marine mammal or bird take numbers, as shown in Table 6.1. Randomization tests were used to test for relationships for the 2012 common murre takes but not for the single mammal take. For variables the tests were for a significant mean difference between observations with or without common murre takes while for factors the tests were to see whether the proportion of factor levels for observations with takes are significantly different from the proportions for all observations. The results for these tests were that there is a highly significant effect of the day number in the fishing season, with takes tending to occur towards the end of the season, there is a significant effect for the midtime code, with takes tending to occur from midnight to 6 am and from 6 am to noon, and a significant effect for the minimum distance to shore code, with takes tending to occur at 500 meters or more from the shore (Table 6.2 and Figure 6.2).

Similar randomization tests were carried out using the 2013 data from common murre takes, all bird takes, and mammal takes (Table 6.3). There were very similar results for common murre takes and for all bird takes, with nine of the 14 variables and factors showing significant results. There was evidence that bird takes tended to occur later in the fishing season, when temperatures were lower, with moderate water clarity, at higher minimum distances to shore, from midnight to 6am, in subdistrict 6A, more than one mile from shore, and without a hydraulic pump operating (Figures 6.4 and 6.5).

There were fewer significant results from randomization tests on the 2013 marine mammal take data because there were only six takes. In this case there were only significant results for the observed effort time, the water clarity and the tide code, with the takes occurring with slightly higher mean observation times, at low water clarity and with all takes occurring during ebb tides (Figure 6.6).

Why So Many More Takes in 2013?

A crucial question is why there were so many more takes of mammals and birds in 2013 than in 2012. This is not just because there was more fishing and more observed fishing periods in 2013 because, for example, the number of bird takes per observed observation period was 0.0075 in 2012 and about five times higher in 2013 at 0.0390.

Another possibility is that the distributions of the variables and factors recorded by the observers was not the same in both years and this led to more takes in 2013 because randomization tests have provided clear evidence that the take numbers are related to some of these variables and factors. To examine this possibility randomization tests were first carried out to see if there are significant differences in the distributions of the variables and factors for the two years. These tests give clear evidence of year differences between the means for all the variables except the effort time observed (Table 6.4) and clear evidence of year differences between the distributions for the eight factors tested (Table 6.5). This is not surprising because of the very high runs for pink and coho salmon in 2013 leading to increased fishing effort, presumably leading to other changes in the fishing conditions, and suggests that the higher take numbers in 2013 than in 2012 could be due to the recorded differences in the fishing conditions.

To examine this further for the takes of all birds, for which there is most data, a log-linear model was fitted for the effect of the nine significant variables and factors for the all bird data as shown in Table 6.3. Non-significant effects in that model were then removed until all of the remaining variables had significant effects at the 5% level or better, and all of the remaining factors had at least one parameter with an effect significant at the 5% level (Table 6.6). This model then has the expected take of all birds related to the day in the fishing season, the effort time observed, the midtime code, the subregion, and the land code. It predicts that the highest takes will tend to occur later in the fishing season, with a high observed effort time, from midnight to 6 am, in subregion 6A and more than one mile to shore, which is consistent with the results from randomization tests on the individual variables and factors for all birds.

However, when the fitted model is used to predict what the all bird take should have been in 2012 it gives a total take of 57.6 birds. Therefore this model does not account for the observed take of only 13 birds in 2012 which was apparently due to some other differences between the fishing in the two years such as possibly a low number of birds in subdistricts 6, 7 and 8 in Southeast Alaska in 2012.

Estimated Net Blow-Through Numbers

As well as the estimating the total takes of marine mammals and birds in districts 6, 7 and 8 of Southeast Alaska there is also interest in estimating the number of net blow-throughs in these districts, where these are thought to be mainly caused by humpback whales. The total blow-throughs can be estimated using the same methods as were used for estimating the total marine mammal and bird takes. There were three observed blow-throughs in subdistricts 6A and 6B in 2012, giving an estimated total number of blow-throughs of 46, with a 95% confidence interval of 3 to 103 (Table 7.1). There were also three observed blow-throughs in 2013 so that the estimated total blow-throughs is similar for 2012 and 2013, with the 2013 estimate being 47 with a 95% confidence interval of 3 to 106 (Table 7.2).

References

Agler, B.A., Kendall, S.J., Seiser, P.E. and Lindell, J.R. (1995). *Estimates of Marine Bird and Sea Otter Abundance in Southeast Alaska During Summer 1994*. U.S. Fish and Wildlife Service report dated March 1995.

AMMOP (2013). *Alaska Marine Mammal Observer Program Observer Manual 2013*. National Oceanic and Atmospheric Administration.

Allen, B.M. and Angliss, R.P. (2012). *Alaska Marine Mammal Stock Assessments, 2011*. United States Department of Commerce, NOAA Technical Memorandum NMFS-AFSC-234.

ASRG. (1998). *Minutes of the Seventh Meeting of the Alaska Scientific Review Group (2-4 June 1998)*. National Marine Fisheries Laboratory, Alaska Fisheries Science Center, Seattle, Washington.

Cochran, W.G. (1977). *Sampling Techniques*, 3rd Edition. Wiley and Sons, New York.

Credle, V.R., DeMaster, D.P., Merklein, M.M., Hanson, M.B., Karp, W.A., and Fitzgerald, S.M., Eds. (1994). *NMFS Observer Programs: Minutes and Recommendations from a Workshop Held in Galveston, Texas, November 10-11, 1993*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Technical Memorandum NMFS-OPR-94-1.

Hodges, J.I., Groves, D.J. and Conant, B.P. (2008). Distribution and Abundance of Waterbirds near shore in Southeast Alaska, 1997-2003. *Northwestern Naturalist* 89: 85-96.

Manly, B.F.J. (2006). *Incidental Catch and Interactions of Marine Mammals and Birds in the Cook Inlet Salmon Driftnet and Setnet Fisheries, 1999-2000*. Western EcoSystems Technology, Cheyenne, Wyoming.

Manly, B.F.J. (2007a). *Incidental Take and Interactions of Marine Mammals and Birds in the Kodiak Island Salmon Setnet Fishery, 2002 and 2005*. Western EcoSystems Technology, Cheyenne, Wyoming.

Manly, B.F.J. (2007b). *Randomization, Bootstrap and Monte Carlo Methods in Biology*, 3rd Edition. Chapman & Hall/CRC, Boca Raton.

Manly, B.F.J. (2010a). *Incidental Take and Interactions of Marine Mammals and Birds in the Yakutat Salmon Setnet Fishery, 2007 and 2008*. Western EcoSystems Technology report dated 24 January 2010.

Manly, B.F.J. (2010b). *Possible Sampling Plans for the Southeast Alaska Drift Gillnet Fishery*. Western EcoSystems Technology Inc. report dated 7 January 2010.

Saltwater Inc. (2013). *Alaska Marine Mammal Observer Program 2012 Post-Season Report*. Saltwater Inc., 733 N Street, Anchorage, Alaska 99501 (website: www.saltwaterinc.com).

Sheaffer, R.L., Mendenhall, W. and Ott, L. (1990). *Elementary Survey Sampling*. PWS-Kent, Boston.

Wade, P.R. and Angliss, R. (1997). *Guidelines for Assessing Marine Mammal Stocks: Report of the GAMMS Workshop, April 3-5, 1996, Seattle, Washington*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-OPR-12.

Wynne, K., Hicks, D. and Munro, N. (1991). *1990 Salmon Gillnet Fisheries Observer Programs in Prince William Sound and South Unimak, Alaska*. Saltwater Inc., Anchorage, Alaska.

Wynne, K., Hicks, D. and Munro, N. (1992). *1991 Marine Mammal Observer Program for the Salmon Driftnet Fishery of Prince William Sound, Alaska*. Saltwater Inc., Anchorage, Alaska.

Appendix: Forms Used by Observers

The following forms are those used by observers for recording information on hauls, gear characteristics, the permits sampled and the nature of any events or marine mammal takes that occurred whilst they were observing. It is these forms that provided most of the data needed for the analyses of data used in this report.

Drift Gillnet Haul Form

Year	Month	Permit Sample ID #	Haul #	Net ID #	
2012					

Marine Zone	Land Feature	Tide	ADFG Statistical Area	Water Temp (0.0 C)
1 = Open water 2 = Large bay 3 = Sheltered bay 4 = River 5 = Channel or canal 6 = River mouth/estuary 7 = River mouth/open water 8 = Creek or waterfall 9 = Other (comment)	1 = Main shoreline 2 = Peninsula /small island 3 = Sand bar 4 = Rocky reef 5 = Submerged land 6 = Prominent point 7 = > 1 mi to shore 9 = Other (comment)	1 = Ebb 2 = Flood 3 = High slack 4 = Low slack 9 = Other (comment)	Water Clarity (0.0m)	Air Temp (0.0 C)
Distance to Shore - Min (m)	Distance to Shore - Max (m)	Hydraulic Pump Used? Y N		Target Species & Code

Set Observed ?	Incidental Take Observed ?	Evidence of Net "Blow Through" ?	Net View Rank Code
Y N	Y N	Y N	Record code 1-4 or 9 (other). Record in comments how rank was determined.

	Date (mmddyy)	Time (24 hr)	Latitude (ddmm.m)	Longitude (dddmm.m)	Water Depth (fm)
Set Begin					
Set End					
Haul Begin					
Haul End					

% Net Hauled	% Net Observed	Cork Line Shape & Net End Tension Drawing	SOAK INFO	# Times Net Run
Gear Damage Codes: 1= no damage 2= < 5%of net torn 3= 5%< net torn < 25% 4= 25%< net torn < 50% 5= net torn > 50% 8= net totally balled up 9= other (comment) 0= unknown	Gear Damage Location **Vertical** V1=bottom third of net V2=middle third of net V3= top third of net 0 = unknown **Horizontal** H1=1st third of net closest to F/V H2= middle third of net H3=last third of net from F/V 0=unknown	Begin Soak:	Cork Line Shape – Begin Soak	Net End Tension – Begin Soak
Gear Obstruction Codes: 1= obstructed by debris < 33% 2= debris obstruction between 33% & 66% 3= obstructed by debris > 66% 4= no obstruction 9= other (comment) 0= unknown		End Soak:	Cork Line Shape – End Soak	Net End Tension – End Soak
			# Cork Line Shape Changes (See Event Form)	# Tension Adjustments (see Event Form)
			Cork Line Shape Codes 1 = straight 2 = curved; 0 - 30° arc 3 = curved; 31 - 60° arc 4 = curved; 61 - 120° arc 5 = curved; 121 - 180° arc 6 = sinous 7 = sudden submergence or shape Δ 9 = other (comment) 0= unknown	Net End Tension Codes 1= straight / taut 2= < 10 corks no tension 3= 10- 20 corks no tension 4= > 20 corks no tension 9 = other (comment) 0= unknown

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Catch Information:

Number & Weight Codes:	Catch Disposition Codes:	Animal Condition Codes:
A = Actual E = Observer Estimate F = Fisherman's Estimate L = Landing/Fish Ticket U = Unknown	K = Kept D = Discarded U = Unknown	A = Alive D = Dead R = Recovering Tank U = Unknown

Species Name and Code	Number	Number Code	Weight (0.0 kg)	Weight Code	Catch Disposition	Animal Condition	Reason (see manual for codes)

COMMENTS:

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NOAA Fisheries Alaska Marine Mammal Observer Program

Drift Gillnet Gear Characteristics Form

Year	Month	Permit Sample ID	Net ID #
2013			

TOW (TAG) LINE Used? Y N

TOW (TAG) LINE length (feet)

TOW (TAG) LINE Material
1= twisted poly
2 = braided poly
3 = braided nylon
4 = twisted nylon
9 = other
0 = unknown

TOW (TAG) Diameter (inches)

Dropline Used? Y N

Dropline Length (inches)

Dropline Material
1= twisted poly
2 = braided poly
3 = twisted nylon
4 = braided nylon
9 = other
0=unknown

Distance Between Droplines (inches)

# of Breast Lines Used

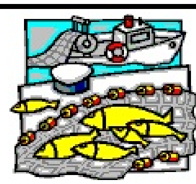
Breast Line Length (# meshes)

Breast Line Material
1= twisted poly
2 = braided poly
3 = twisted nylon
4 = braided nylon
9 = other
0=unknown

Weedline Used? Y N

Weedline Length (fm)

Weedline Material
1= twisted poly
2 = braided poly
3 = twisted nylon
4 = braided nylon
9 = other
0=unknown



Breast Line Hose / Hoop Used? Y N

Bags/Bouys

True (hang) Ratio

Leadline Weight (lbs/100 fm)

Total # Panels

Shackle Used? Y N

CORK LINE INFO:

Cork Line Length (fm)

Cork Line Material
1= twisted poly
2 = braided poly
3 = braided nylon
4 = Sampson braid
9 = other
0=unknown

Corks

Distance Between Corks (center to center) (inches)

Cork Shape & Length

Shape	Code	Count	Length (")
Sphere/ball	1		
Disk/cylinder	2		
Oval/football	3		
3D rectangle	4		
Cube	5		
Bullet	6		
Combination (comment)	8		
Other (comment)	9		

Cork Pattern (Color/shape)

Cork Color

Color	Code	Count
Clear	1	
White	2	
Yellow	10	
Orange	9	
Red	7	
Blue	6	
Green	5	
Pink	8	
Gray	4	
Black	3	
Purple	11	
Tan	12	
Combination	13	
Other	99	

Pingers Used? Y N

Pingers

Pinger Brand

Pinger Frequency (kHz)

Pinger Location on Net:

Horizontal (distance from one end) (fathoms)

Vertical (depth from weedline - mesh count)

Pinger(s) Operational? Y N

Form AMMOP 002-2013 OMB APPROVAL # EXPIRES

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Panel Type #1	
# Panels This Type	
Panel Length (fm)	
Panel Depth (mesh count)	
Mesh Size – min (")	
Mesh Size – max(")	
Twine Size	
Twine Manufacturer	
Twine material 3 = six-strand monotwist 4 = multi-strand monotwist 7= super six strand (MA6) 8 = combination 9 = other (comment)	
Twine color 1 = clear 2 = white 3 = black 4 = gray 11 = purple 12 = tan 13 = combination 20 = bluish-green 22 = bluish-greenish-grayish 23 = light blue 24 = medium blue 25 = dark blue 26 = light green 27 = medium green 28 = dark green 99 = other	

Panel Type #2	
# Panels This Type	
Panel Length (fm)	
Panel Depth (mesh count)	
Mesh Size - min(")	
Mesh Size – max(")	
Twine Size	
Twine Manufacturer	
Twine material 3 = six-strand monotwist 4 = multi-strand monotwist 7= super six strand (MA6) 8 = combination 9 = other (comment)	
Twine color 1 = clear 2 = white 3 = black 4 = gray 11 = purple 12 = tan 13 = combination 20 = bluish-green 22 = bluish-greenish-grayish 23 = light blue 24 = medium blue 25 = dark blue 26 = light green 27 = medium green 28 = dark green 99 = other	

Panel Type #3	
# Panels This Type	
Panel Length (fm)	
Panel Depth (mesh count)	
Mesh Size – min (")	
Mesh Size - max(")	
Twine Size	
Twine Manufacturer	
Twine material 3 = six-strand monotwist 4 = multi-strand monotwist 7= super six strand (MA6) 8 = combination 9 = other (comment)	
Twine color 1 = clear 2 = white 3 = black 4 = gray 11 = purple 12 = tan 13 = combination 20 = bluish-green 22 = bluish-greenish-grayish 23 = light blue 24 = medium blue 25 = dark blue 26 = light green 27 = medium green 28 = dark green 99 = other	

Panel Type #4	
# Panels This Type	
Panel Length (fm)	
Panel Depth (mesh count)	
Mesh Size – min (")	
Mesh Size - max(")	
Twine Size	
Twine Manufacturer	
Twine material 3 = six-strand monotwist 4 = multi-strand monotwist 7= super six strand (MA6) 8 = combination 9 = other (comment)	
Twine color 1 = clear 2 = white 3 = black 4 = gray 11 = purple 12 = tan 13 = combination 20 = bluish-green 22 = bluish-greenish-grayish 23 = light blue 24 = medium blue 25 = dark blue 26 = light green 27 = medium green 28 = dark green 99 = other	

Panel Type #5	
# Panels This Type	
Panel Length (fm)	
Panel Depth (mesh count)	
Mesh Size – min (")	
Mesh Size – max (")	
Twine Size	
Twine Manufacturer	
Twine material 3 = six-strand monotwist 4 = multi-strand monotwist 7= super six strand (MA6) 8 = combination 9 = other (comment)	
Twine color 1 = clear 2 = white 3 = black 4 = gray 11 = purple 12 = tan 13 = combination 20 = bluish-green 22 = bluish-greenish-grayish 23 = light blue 24 = medium blue 25 = dark blue 26 = light green 27 = medium green 28 = dark green 99 = other	

Panel Type #6	
# Panels This Type	
Panel Length (fm)	
Panel Depth (mesh count)	
Mesh Size – min (")	
Mesh Size – max (")	
Twine Size	
Twine Manufacturer	
Twine material 3 = six-strand monotwist 4 = multi-strand monotwist 7= super six strand (MA6) 8 = combination 9 = other (comment)	
Twine color 1 = clear 2 = white 3 = black 4 = gray 11 = purple 12 = tan 13 = combination 20 = bluish-green 22 = bluish-greenish-grayish 23 = light blue 24 = medium blue 25 = dark blue 26 = light green 27 = medium green 28 = dark green 99 = other	

COMMENTS:

Form AMMOP 002-2013 OMB APPROVAL # EXPIRES

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Permit Sample Information Form

Year	Month	Permit Sample ID #	Fishery Name & Code	Geographical Region & Code
2013			Southeast Alaska Salmon Drift Gillnet SO3A	SE AK Districts 6, 8, & 7A

Permit Sample Begin Date	Permit Sample Begin Time	Permit Sample End Date	Permit Sample End Time	ADFG Statistical Areas Sampled

CFEC Fishing Permit #	Permit Selection Type 1 Primary/Random 2 Secondary/(Haphzd/Adapt) 9 Other	Adaptive Sampling		Permit Sample Type 1 Fully Observed 2 Partially Observed 3 Arrested 9 Other
		Y N		Operation Type 1 = Single Operator

Total # Individual Hauls Observed (whole # count for each P, W & T)			# Hauls NOT Observed PRIOR TO Obs Arrival (whole # count for each P, W & T + decimal not obs for each ind partial haul sep by commas)	# Hauls NOT Observed DURING Observer Presence (whole # count for each P, W & T + decimal not obs for each ind partial haul sep by commas)			Permit Holder's EXPECTED # Hauls for Day (whole # count)	Permit Holder's EXPECTED # Hauls AFTER Observer Departure (whole # count)	CONFIRMED # Hauls NOT Observed AFTER Observer Departure (whole # count)
OBS 1	OBS 2	TOT		OBS 1	OBS 2	TOT			
P	P	P	P	P	P	P			
W	W	W	W	W	W	W			
T	T	T	T	T	T	T			

Total # Marine Mammal Incidental Takes	Primary Species Retained (name & code)	# Deliveries	Delivery Location Name
Total # Seabird Incidental Takes	# Primary Species Retained	Delivery Location 1 = tender 2 = processing plant 3 = direct market 9 = other 0 = unknown	

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Comments (continued on back: Y N)

Tracking	Debriefed	Received by NMFS	Reviewed by NMFS	Data Entered
Date				
Initials				

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NOAA Fisheries Alaska Marine Mammal Observer Program

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Event Log and Marine Mammal Sighting Form

Year 2013	Month	Day	Permit Sample ID #

Event					Environmental Conditions				Fishing Activity					Marine Mammal Sightings										
Event #	Event Type	Time (24 hr - hhmm)	Latitude (ddmm.mm)	Longitude (dddmm.mm)	Cloud Cover	Precip.	Beaufort Sea State	Wave Height (0.1 m)	% Net Ran	Cork Line Shape	Cause- Cork Line Shape Δ	Net End Tension	Cause- Net End Tension Δ	Species Code	Species Name	# in Group	Animal Behavior	Animal Condition	Animal Distance to Fishing Vessel (m)	Animal Distance to Net - Initial (m)	Animal Distance to Net - closest (m)	Animal Location Along Net	Animal Interaction w Net	Fisherman response to MM approach

Event Type Codes

Observer Events:
1 = begin haul watch
2 = end haul watch
3 = begin transit watch
4 = end transit watch
5 = begin set watch
6 = end set watch
7 = begin soak watch
8 = end soak watch
11 = mm sighting; on watch
12 = mm sighting; off watch

Fishing Events:
13 = F/V ran net
14= cork line shape Δ
15= net end tension Δ
99 = other (comment)

Cloud Cover Codes
1 = Clear (<10% cloud cover)
2 = Partly cloudy (10-50% cloud cover)
3 = Cloudy (51-90% cloud cover)
4 = Overcast (>90% cloud cover)
0 = unknown

Precipitation Codes
1 = light rain
2 = heavy rain
3 = hail
4 = fog
5 = sleet or snow
6 = no precipitation
7 = combination fog and rain
0 = unknown

Beaufort Wind Speed/Sea State Codes
0 = < 1 kt mirror-like surface
1 = 1-3 kt ripples / no foam crests
2 = 4-6 kt small wavelets / crests glassy – not breaking
3 = 7-10 kt large wavelets / breaking crests / some whitecaps
4 = 11-16 kt small waves / numerous whitecaps
5 = 17-21 kt moderate waves / many whitecaps / some spray
6 = 22-27 kt large waves / whitecaps everywhere
7 = 28-33 kt sea heaps up / streaks of foam
8 = 34-40 kt moderate high waves / ~~spindrift~~ blowing foam

Cork Line Shape & Net Tension Δ Cause Codes
F = fishing activity cause
D = drift cause (wind or current)
U = unknown cause

Cork Line Shape Codes
1 = straight
2 = curved; 0 - 30° arc
3 = curved; 31 - 60° arc
4 = curved; 61 - 120° arc
5 = curved; 121 - 180° arc
6 = ~~sinuous~~
7= sudden/ temp submegence / shape Δ
9 = other (comment)
0= unknown

Net End Tension Codes
1= straight / taut
2= < 10 corks -no tension
3= 10-20 corks -no tension
4= > 20 corks -no tension
5 = sudden/ temporary tension Δ
9 = other (comment)
0= unknown

Species Code
See Observer Manual

Animal Condition Codes
1= no unusual observations
2= hair loss on head
3= hair loss on body
4= lesions on head
5= lesions on neck/shoulders
6= lesions on body
7= lesions on front flippers
8= lesions on back flippers
9= other
0= unknown

Animal Behavior Codes
1 = Swimming
2 = Milling / circling
3 = Sounding
4 = ~~Porpoising~~
5 = Bow riding
6 = Breaching
7 = Thrashing
11 = Feeding on catch
12 = Foraging on other prey
13 = Floating on surface
14 = Vessel or net avoidance
16 = On land/hauled out
17 = Dead
18 =Loss of shyness/lack of avoidance
19 = Approach to net w/in 20 meters
20 = Approach to net within 10 meters
21 = Approach to net within 5 meters
22 = Physical contact with net
9 = Other (comment)
0 = unknown

Location Along Net
1 = 1st qtr of net from obs.
2 = 2nd qtr of net from obs.
3 = 3rd qtr of net from obs.
4 = 4th tqr of net from obs.

Animal Net Interaction
Y = Yes (comments)
N = No

Fisherman Response
1= no response
2= change net tension
3= change cork line shape
4= run net
5 = make noise
6 = haul initiated
9 = other (comments)

Form AMMOP 008-2013

OMB approval #xxx expires xxx

Event Log and Marine Mammal Sighting Form

Year 2013	Month	Day	Permit Sample ID #

Event					Environmental Conditions				Fishing Activity					Marine Mammal Sightings										
Event #	Event Type	Time (24 hr - hhmm)	Latitude (ddmm.mm)	Longitude (dddmm.mm)	Cloud Cover	Precip.	Beaufort Sea State	Wave Height (0.1 m)	% Net Ran	Cork Line Shape	Cause-Cork Line Shape Δ	Net End Tension	Cause-Net End Tension Δ	Species Code	Species Name	# In Group	Animal Behavior	Animal Condition	Animal Distance to Fishing Vessel (m)	Animal Distance to Net - Initial (m)	Animal Distance to Net - closest (m)	Animal Location Along Net	Animal Interaction w Net	Fisherman response to MM approach

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OMB approval # xxx expires xxx