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Summary of Reported Atlantic Salmon (*Salmo salar*) Catches and Sightings in British Columbia and Adjacent Waters in 1994

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SUMMARY OF REPORTED ATLANTIC SALMON (*Salmo salar*) CATCHES AND SIGHTINGS IN BRITISH COLUMBIA AND ADJACENT WATERS IN 1994

by

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ABSTRACT

Thomson, A. J. and S. McKinnell. 1995. Summary of reported Atlantic salmon (*Salmo salar*) catches and sightings in British Columbia and adjacent waters in 1994. Can. Manuscr. Rep. Fish. Aquat. Sci. 2304: 33 p.

A program to monitor the abundance and distribution of Atlantic salmon (*Salmo salar*) in British Columbia was conducted jointly by the Canadian Department of Fisheries and Oceans (D.F.O.) and the British Columbia Ministry of Agriculture, Fisheries and Food in 1994, with the cooperation of the British Columbia Ministry of Environment, Lands and Parks. The study consisted of contacting individuals and agencies involved with salmonoid fisheries, research and enhancement as well as all major commercial fish buyers, advising them to return or report all Atlantic salmon to D.F.O.. Catches of Atlantic salmon in the Department of Fisheries and Oceans sales slip and mark recovery databases were reviewed. One thousand and sixty-eight Atlantic salmon were either returned or reported to D.F.O., 31 of which were sighted or captured in freshwater. One hundred and seven fish were returned to the Pacific Biological Station for analysis and species verification. Ninety-one percent of the reported Atlantic salmon catch was caught in statistical area 12 (Johnstone Strait). Twenty-nine Atlantic salmon were reported caught in Alaskan commercial fisheries in 1994 and 363 were reported caught in Washington State.

RÉSUMÉ

Thomson, A. J. and S. McKinnell. 1995. Summary of reported Atlantic salmon (*Salmo salar*) catches and sightings in British Columbia and adjacent waters in 1994. Can. Manuscr. Rep. Fish. Aquat. Sci. 2304: 33 p.

En 1994, il y avait un programme pour étudier l'abondance et la répartition des saumons de l'atlantique (*Salmo salar*) dans les eaux de la Columbie Britannique. L'étude a été conduite conjointement par le ministère fédéral des Pêche at des Océans (MPO) et le ministère de l'Agriculture, de la Pêche et de la Nourriture de la Columbie Britannique, avec la coopération du le ministère de l'Environnement, des Terre et Parc's de la Columbie Britannique. Pour cette étude, nous nous sommes mis en contact avec des individus et des agences qui s'interessent á la pêche au saumon, á la recherche ou á l'amélioration du cheptel des saumons, et aussi avec des acheteurs commerciaux majeurs des poissons, et leur ont demandé d'envoyer ou de signaler tous les saumons de l'atlantique qu'ils rencontraient au MPO. Aussi, nous avons examiné les renseignements des saumons de l'atlantique dans la base des données du ministère des Pêches et des Océans qui recueille les reprises de poissons étiquetés et les bordereaux d'achat. Au total cela a fait 1068 saumons de l'atlantique rendus ou signalés, dont 31 ont été trouvés dans l'eau douce. 107 poissons étaient envoyés a la Station de biologie Pacifique ou nous les avons analysés et verifiés l'espèce. Quatre-vingt-onze pour cent de la prise rapportee des saumons de l'atlantique ont été pêchés dans le douzième secteur statistique (le détroit de Johnstone). Pendant la même annee, on a aussi rapporté que vingt-noeuf saumons de l'atlantique ont été pris commercialement dans les eaux d'Alaska, et que 363 en ont été capturés par la pêche commerciale dans les eaux de Washington.

INTRODUCTION

In 1991, a joint federal / provincial program was initiated by the British Columbia Ministry of Agriculture, Fisheries and Food and the Canadian Department of Fisheries and Oceans to monitor the presence of Atlantic salmon (*Salmo salar*) in British Columbia (B.C.) coastal streams. In 1992, an expanded Atlantic Salmon Watch program was launched to monitor commercial and sport catches and observations of Atlantic salmon (Thomson and McKinnell, 1993). In 1993, the Atlantic Salmon Watch program was expanded to survey a greater number of fisheries officials and volunteers (Thomson and McKinnell, 1994). In 1994 the program was conducted in the same manner as in 1993 with the increased participation of the British Columbia Ministry of Environment, Lands and Parks (B.C. M.E.L.P.).

The monitoring program's main objectives are: increasing the general awareness of the presence of Atlantic salmon in B.C. waters, expanding the reporting of Atlantic salmon, maintaining a database of the number of Atlantic salmon reported and/or observed in B.C., and preparing annual reports of catches or sightings of Atlantic salmon. An Atlantic salmon biological database is also maintained.

METHODS

The program consisted of three main efforts: 1) contacting a large number of individuals working in fisheries related activities to alert them to the monitoring program, 2) collecting and analyzing as many of the captured Atlantic salmon as possible, and 3) retrieving catch data from several sources to provide information about the number of Atlantic salmon observed in B.C. in 1994.

Department of Fisheries and Oceans field offices, hatcheries, and Public Involvement Program Hatcheries, Ministry of Environment, Lands and Parks coastal offices, and all major salmon processors were contacted, to alert them to the presence of Atlantic salmon, to provide them with the necessary information to identify Atlantic salmon, and to request that they provide any information they receive or Atlantic salmon they encounter.

In October, 1994 the B.C. M.E.L.P. initiated a program to actively search selected B.C. rivers and streams for the presence of Atlantic salmon. The criteria used for selecting rivers to investigate were those that; 1) had prior reports of Atlantic salmon, 2) were near Atlantic salmon net pen sites which had recently reported escapes, 3) had Atlantic salmon hatcheries located on them. A total of 31 streams or portions thereof were surveyed. With one exception, all were on Vancouver Island.

Fish sent to the Pacific Biological Station (PBS) were examined to verify species identification. Sex, fork length, body weight, gonad weight, stomach contents, and a qualitative index of fat content were recorded. A power outage prevented recording some gonad and body weights. Scales were sampled for age and/or scale growth determination. Tissue samples were obtained for genetic analysis. Some fish were also analzyed by the Fish Pathology Program at the Pacific Biological Station.

A truck load of parr was accidentally spilled into Morstrom Creek, located between Campbell River and Brown's Bay. A sample of parr collected from Morstom Creek was analyzed for weight, fork length and maturity level. Tests for infectious diseases known to occur among cultured salmonids were done by the Fish Pathology Program. Ten parr collected on December 12, 1994 underwent a seawater challenge test (Blackborn and Clarke, 1987) to determine their salt water tolerance.

Fat content of each fish was assessed visually on a qualitative scale from 0 to 4. Zero indicated a dressed or greatly decomposed fish where no fat could be found, 1 indicated trace amounts of fat present, 2 indicated larger amounts of fat on major organs, 3 indicated extensive fat throughout the pyloric caeca, and 4 indicated organs completely encased in fat.

Atlantic salmon catch statistics data for B.C. were obtained from two main sources: the Department of Fisheries and Oceans sales slip database and the Mark Recovery Program database. Catch data for Washington State were obtained from the Washington State Department of Fisheries. Alaskan catch data is supplied by the Auke Bay Laboratory of the National Marine Fisheries Service and the Alaskan Department of Fish and Game.

RESULTS AND DISCUSSION

Escapes of Atlantic salmon

Aquaculture facilities are required to report escapes of Atlantic salmon to the Department of Fisheries and Oceans. From June 1988 to 1993, 21,200 Atlantic salmon escaped from B.C. aquaculture facilities in 7 reported incidents. In 1994, 64,229 Atlantic salmon escaped from net-pen facilities in B.C. in 7 reported incidents. The smallest reported escape was 1,713 fish and the largest was 21,500. The actual number of escapes is unknown. Reporting escapes is a voluntary condition of license. Most of the reported escapes occurred in the Johnstone Strait region.

In addition to escapes from marine sites, on November 24, 1994 a tractor trailer carrying 37,000 - 50,000 Atlantic salmon parr slid off a road and spilled approximately 20,000 fish, of which an estimated 7,000 escaped into the adjacent Morstom Creek on Vancouver Island (P. Law, B.C.M.E.L.P., pers. comm.).

Marine Recoveries and Sightings

Within B.C. waters, Atlantic salmon were reported from as far north as Area 3, Dundas Island, and as far south as Area 19, Victoria (Figures 1 and 2). The number of documented recoveries of Atlantic salmon caught in marine fisheries in 1994 was 1037. This total was obtained by summing the reported catches of Atlantic salmon in the D.F.O. sales slip database, the Mark Recovery database, and those received by the Atlantic Salmon Watch program (A.S.W.P.). The true number of Atlantic salmon caught exceeds this by some unknown factor. In 1993 4,555 Atlantic salmon were confirmed caught (Thomson and McKinnell, 1994). The majority of the 1993 catch of Atlantic salmon was taken in a single week in an area in which

two escapes had recently occurred. Unlike 1993, the number of reported recoveries in 1994 was significantly less than the number of reported escapes.

Catagory/Source	Sales Slip	M.R.P.	A.S.W.P.	Total
Marine	406	5*	626	1037
Freshwater	0	0	31	31

* The M.R.P. database actually lists 88 Atlantic salmon landed but only five of these were found to not be also recorded in the sales slip database.

The Department of Fisheries and Oceans sales slip database for commercial fishing vessels lists 406 Atlantic salmon sold. Various data sources can provide conflicting information on Atlantic salmon catches. The sales slip database for the first week in October reports only 2 Atlantic salmon landed. During that same week approximately 150 fish were collected from 2 processors at Sointula for the Atlantic Salmon Watch program. Seventy were delivered to the Pacific Biological Station. An additional 400 were estimated by a fisheries guardian to have been caught in the same fishery. This discrepancy between known catches and the sales slip database indicates that the Atlantic salmon catches reported in the D.F.O. sales slip database underestimate the true catch. The net fishery opening in statistical area 12 (Johnstone Strait) for week 8-2 (August 7 to August 14) reported the largest catch of Atlantic salmon at 125 pieces for a single area in a single week.

The Department of Fisheries and Oceans Mark Recovery database lists 88 Atlantic salmon reported in 1994. Of these 5 were not found in the sales slip database. The reporting of Atlantic salmon by the Mark Recovery Program samplers is entirely voluntary.

In Washington State the commercial catch of Atlantic salmon is monitored through the buyer reporting program administered by the Washington State Department of Fisheries. In 1994, the recorded catch of Atlantic salmon in Washington State commercial fisheries was 337 fish (Figure 3). Twelve fish were caught in ceremonial or subsistence tribal fisheries and 23 fish were caught in test fisheries. The majority of the catch occurred in lower Puget Sound with only 7 fish reported from north of Puget Sound.

Although Alaska has no formal reporting program for Atlantic salmon, the National Marine Fisheries Service, Auke Bay Laboratory in Juneau has recorded recoveries of Atlantic salmon since they first appeared in 1990 (Wing et al. 1992). In 1994, 29 fish were reported. Twenty-eight were captured in the commercial net fisheries of Southeast Alaska. Of note is 1 Atlantic salmon that was tagged at the mouth of the Skeena River as a steelhead (*Oncorhynchus mykiss*) by the B.C. M.E.L.P. and caught in a southeast Alaskan seine fishery. A single Atlantic salmon was caught in a set gillnet on August 6, 1994 on the west side of Nagai Island in the Shumagin Islands (Figure 4).

Freshwater recoveries and sightings

In 1994, 31 Atlantic salmon were reported caught or sighted in freshwater through the Atlantic Salmon Watch program (Figure 5). Atlantic salmon continue to be a relatively rare species in freshwater when compared with the abundance of native species of salmon. However, Atlantic salmon are an exotic species in B.C. and they are abundant when compared with the historical, naturally occurring abundance.

The B.C. M.E.L.P. swim surveys located two Atlantic salmon in over 143km of streams surveyed. This low number could indicate that there are few Atlantic salmon to be found in coastal streams or that the extreme high water flows, numerous native species and a later than optimal start in the year impaired the ability to detect Atlantic salmon.

Two attempts were made to study the movements of Atlantic salmon in freshwater. Two fish were radio-tagged with Lotek internal VHF radio transmitter tags. One fish was captured during brood stock collection on the lower Kokish River on October 1, 1994 and released with tag on Oct. 3, 1994. This fish was tracked over a period of 33 days, at first travelling upstream to a point 5km from the capture site and then returning downstream to the estuary. The other radio tagged fish was captured and tagged at the confluence of the Colonial and Cayeaghle rivers on Oct. 16, 94. It is suspected that the tag may have been regurgitated immediately as further tracking efforts showed no movement from a lower estuary pool (Mike Lough, pers. comm.).

Approximately 7,000 parr escaped into Morstom Creek which flows into Morstom Lake. Within 48 hours of the spill, a fence was constructed at the outlet of Morstom Lake to prevent downstream migration of the Atlantic salmon. Electrofishing of the creek above the lake yielded approximately 800 Atlantic salmon which were retained. Electrofishing of the creek below the lake six days after the spill did not produce any Atlantic salmon. Two gillnet sets in the lake captured a small number of Atlantic salmon and a small number of cutthroat trout. The trout had Atlantic salmon parr in their stomachs. The downstream containment fence will be modified in the spring to include a smolt trap to recapture the Atlantic salmon as they attempt to migrate to sea (George Reid, pers. comm.).

The ten pre-smolts taken from Morstom Creek tested for their adaptability to salt water were found to be not ready for the marine environment (J. Blackborn, pers. comm.).

Biological sampling

One hundred and seven marine recoveries of Atlantic salmon from B.C. fisheries were returned to the Pacific Biological Station for biological sampling (Figure 6). Of these 89 were returned from statistical area 12 (Johnstone Strait). The results of the biological sampling of these Atlantic salmon are summarized in Figures 7 and 8. The detailed data are reported in Table 1. Fork lengths ranged from 528 to 710 mm with a mean of 644.6 mm. Round body weights ranged from 1.3 to 4.34 kg with a mean of 3.1 kg.

Murza and Khristoforov (Murza and Khristoforov, 1991) developed a scale of maturity for Atlantic salmon based on weights and external appearance of gonads. Stages I - III are maturing fish, stage IV is a fully mature fish, and stages V and VI are post reproductive stages. Of 22 males the median gonad weight was 3 grams. Eight males were at stage III or higher maturity level. The median gonad weight for 48 females was 8.25 grams, 5 were at maturity level of III(late) or greater.

Of 106 fish analyzed for stomach contents, 3 fish had herring or other fish remains in their stomachs, 2 had algae, 2 had zooplankton and 3 had miscellaneous organic matter. The remaining 96 fish had no identifiable food matter in their stomachs.

Age of the Atlantic salmon based on scale patterns was judged to be difficult to determine. All of the sampled fish had some degree of fin wear, primarily on the dorsal and caudal fins. Fin wear is indicative of net-pen rearing and is an established procedure for the identification of farm raised fish.

Four freshwater recoveries of Atlantic salmon were returned to the Pacific Biological Station for analysis (Figure 9). The results of the biological sampling of these fish are summarized in Table 2. All of the fish showed gonadal development and external coloration associated with sexual maturation.

Fork lengths of the Alaskan recoveries ranged from 508 to 746 mm with a mean of 643.8 mm. Round body weights ranged from 1.5 to 5.2 kg with a mean of 3.7 kg. Of 10 males recovered from marine landings the median gonad weight was 1.5 grams. The median gonad weight for 13 females returned from marine landings was 5.0 grams. Of 23 fish stomachs examined, 20 were empty, 2 had some evidence of fish and 1 had a piece of wood in it. There are no Atlantic salmon aquaculture facilities in Alaska.

Disease

Fifty-five adult fish from B.C. and Alaska were tested for common salmonoid bacterial and viral pathogens and/or unusual parasite infestations by the Fish Pathology Program. Fifty-three showed no unusual signs of disease. One fish taken from Glenlyon Creek was found to be infected with *Aeromonas salmonicida*, the causative agent of furunculosis. Two fish caught in Alaskan fisheries were marginally positive for Bacterial Kidney Disease (BKD) when tested using the Elisa technique.

Sixty parr taken from Morstom Creek after the November 24th spill were tested by the Fish Pathology Program. All appeared free of internal parasites and free of infectious disease agents known to occur in cultured salmonoids in B.C..

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Table 1. Biological data of the marine caught Atlantic salmon that were returned to the Pacific Biological Station.

Fish No.	Sex	Fork Length (mm)	Body Weight (kg)	Gonad Weight (g)	Stomach Content	Fat Content
94002	female	535	1.5	12.5	Euphausid	2
94003	female	601	2.9	6	E	3
94004	female	645	3.53	10	E	3
94005	female	632	2.71	5.5	E	3
94006	female	670	3.2	7.5	E	2
94007	female	618	2.72	7.5	E	3
94008	female	594	2.35	5	E	3
94009	male	656	3.46	170	E	3
94010	female	570	2.05	3	E	3
94011	male	675	3.67	1	E	4
94014	female	629	2.78	8.5	E	3
94015	female	528	1.33	6	E	2
94016	male	630	3.11	205	E	4
94018	male	610	2.47	1	E	3
94019	female	610	2.22	5	Crab Mega.	3
94020	male	675	4.26	11	E	4
94021	female	629	2.64	5	E	3
94022	female	639	2.45	8	E	2
94023	female	634	3.43	17	E	4
94024	female	650	3.13	115.5	E	
94025	male	710	4.34	3	E	3
94026	female	640	3.47	11.1	E	2
94027	female	655	3.49	9	E	3
94028	female	590	2.62	7	E	3
94029	male	665	3	182	E	3
94030	female	645	2.94	6.5	E	2
94031	female	660	3.28	7.5	E	3
94032	male	600	3.03	27	E	3
94033	male	616	2.78	38.5	E	3
94034	female	599	3.1	15.5	E	3
94035	male	588	2.3	73	E	3
94036	female	684	3.66	9.5	E	3
94037	female	615	2.7	6.5	E	3
94038	female	620	2.47	8	E	3
94039	female	709	4	9.5	E	4
94040	male	630	3.03	180	E	4
94041	female	595	2.84	68.5	E	2
94042	female	640			Orange Matter	3
94043	male	679			E	3
94044	male	672			E	3
94045	male	650			E	4
94046	male	651			E	3
94047	male	673			E	4
94048	female	625			E	3
94049	female	620			E	4
94050	male	708			E	4
94051	female	668			E	3
94052	male	672			E	4

Fish No.	Sex	Fork Length (mm)	Body Weight (kg)	Gonad Weight (g)	Stomach Content	Fat Content
94054	female	670			GM	3
94055	male	620			E	3
94056	female	642			Herring	4
94057	male	625			GM	3
94058	male	644			E	3
94059	female	613			E	4
94060	female	639			GM	2
94061	female	587			GM	3
94062	male	660			E	3
94063	male	664			GM	3
94064	female	660			GM	3
94065	male	666			Misc	3
94066	male	625			E	3
94067	male	691			Algae	3
94068	female	662			GM	3
94069	female	654			E	3
94070	male	620			E	3
94071	male	632			E	3
94072	male	675			E	4
94073	female	659			E	4
94074	male	675			E	3
94075	male	618			E	3
94076	female	598			E	4
94077	male	620			E	3
94078	female	660	3.36	11.5	Leaf	3
94079	female	670	3.37	8	E	3
94080	male	678	3.08	1	E	3
94081	female	659	3.12	8	E	4
94082	female	679	2.73	7.5	E	4
94083	female	649	3.13	605.5	E	2
94084	female	646	2.91		E	4
94085	female	692	3.73	8.5	E	3
94086	female	700	3.51	10.5	E	3
94087	female	650	3.02	7	E	3
94088	female	636	2.72	9	E	3
94089	female	654	3.14	8.5	E	3
94090	female	688	3.73	11	E	4
94091	female	680	3.26	6	E	4
94092	female	688	3.34	8.5	E	3
94093	female	710	3.91	8.5	E	3
94094	male	604	2.7	2	E	3
94095	male	665	3.2	2	E	4
94096	female	695	3.85	10	E	2
94097	female	668	3.26	8.5	E	3
94098	female	609	2.7	7	Fish Remains	4
94099	male	660	3.08	4	GM	3
94100	male	611	2.57	3	Algae	3
94101	male	670	3.48	1	E	3

Fish No.	Sex	Fork Length (mm)	Body Weight (kg)	Gonad Weight (g)	Stomach Content	Fat Content
94103	male	672	3.42	3	E	3
94104	male	631	2.94	3	E	3
94105	female	653	3.02	7.5	E	2
94106	male	615	2.82	2	E	4
94107	male	670	3.33	187.5	E	2
94108	female	645	2.9	7	E	2
94109	female	650	3.31	8	GM	3
94110	female	667	3.56	10	Herring	2
94111	female	626	3.06	9.5	E	4

Stomach Content Code.
E = Empty
GM = Grey Matter or Undiscernable Digested Material

Table 2: Biological data of the freshwater caught Atlantic salmon that were returned to the Pacific Biological Station.

Fish No.	Sex	Fork Length (mm)	Body Weight (kg)	Gonad Weight (g)	Stomach Contents	Location	Fat Content
94001	male	570	1.9	45.1	Moss	Kokish R.	2
94012	female	575	1.65	NA	E	Glenlyon C.	1
94013	male	639	2.5	110	E	Nimpkish R.	1
94017	female	660	2.5	19	E	Stamp R.	1

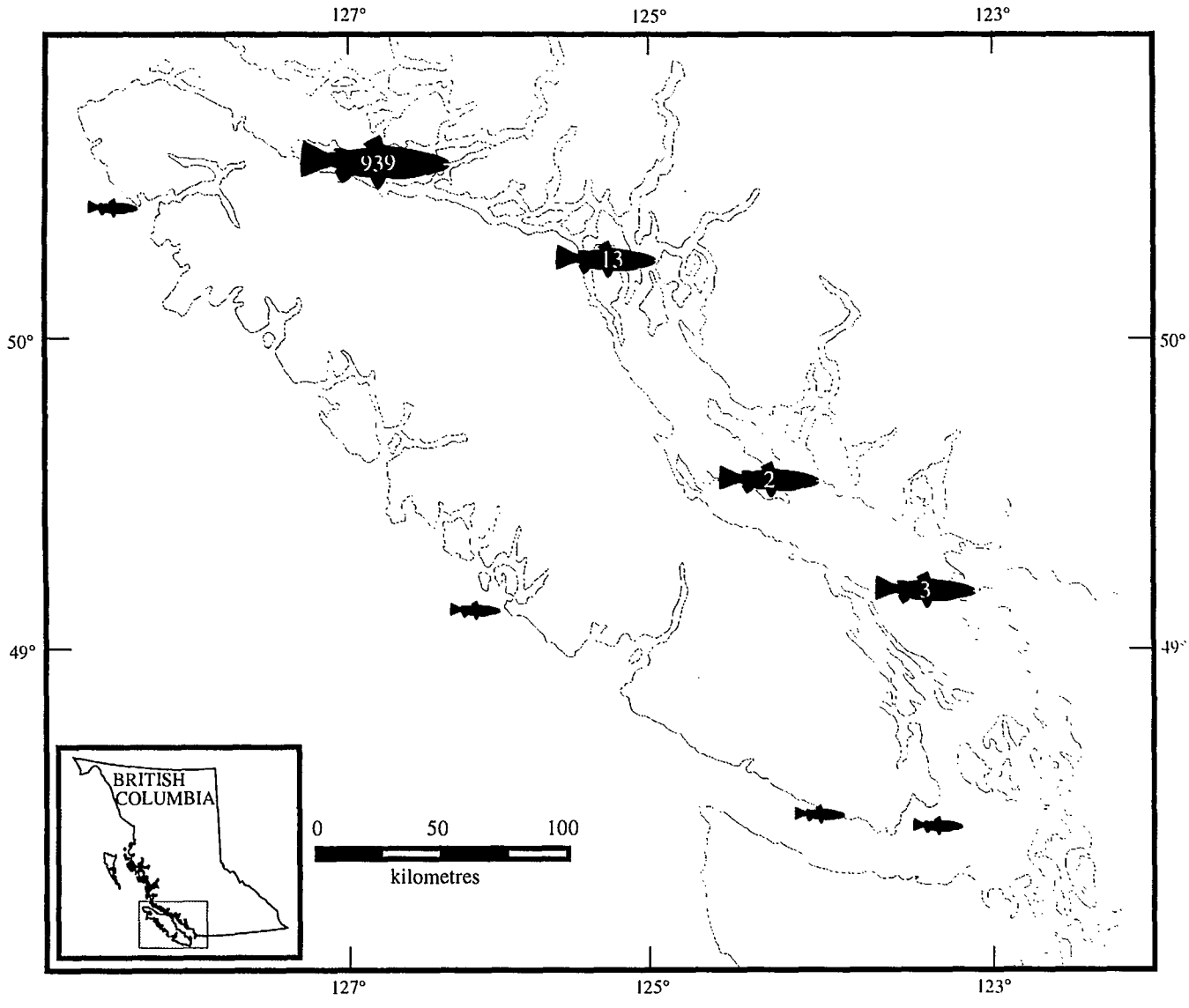


Figure 1. Atlantic salmon reported from marine waters in Southern British Columbia in 1994 by D.F.O. statistical area. Data compiled from Sales slip database, Mark Recovery Program and Atlantic Salmon Watch program.

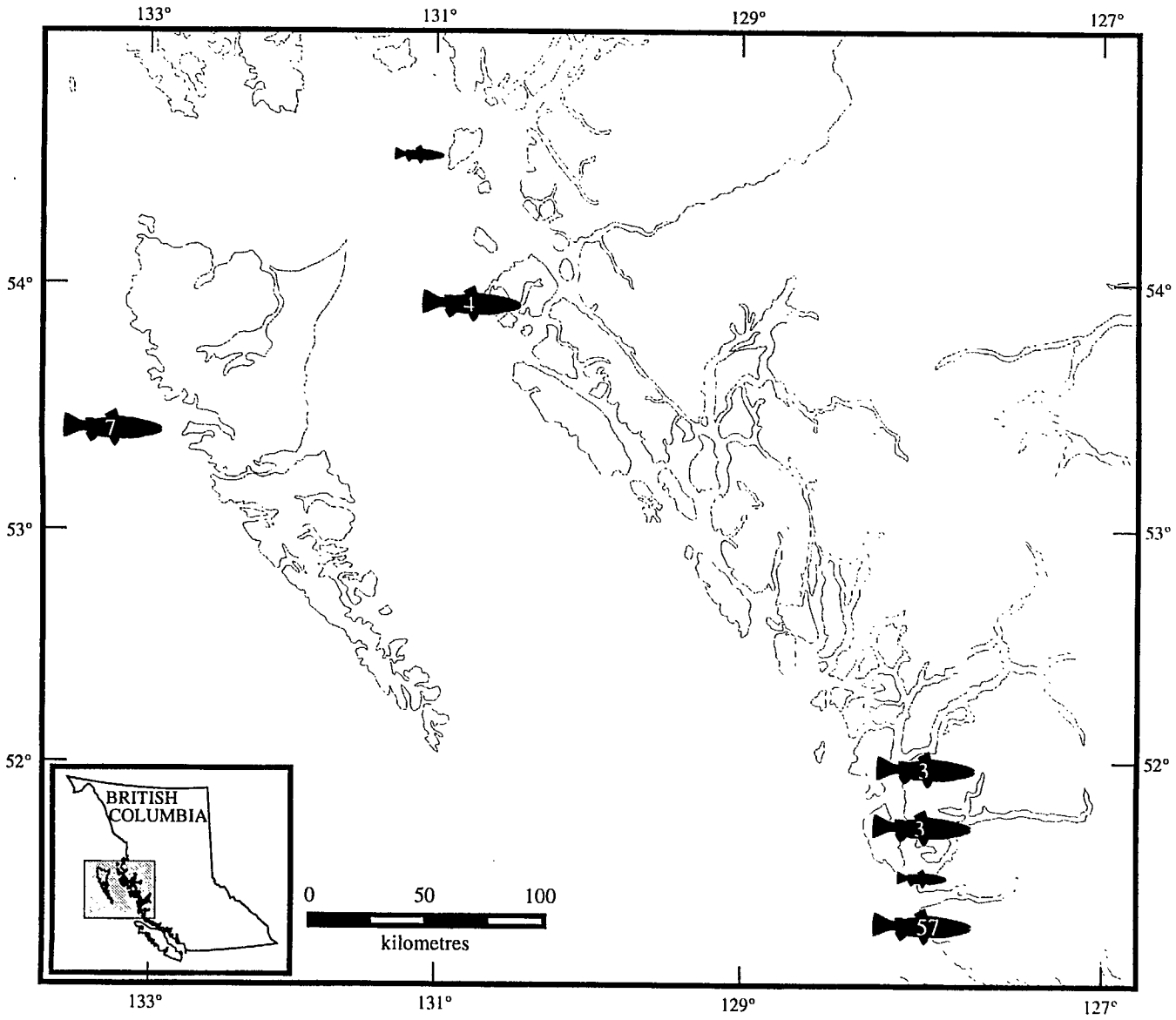


Figure 2. Atlantic salmon reported from marine waters in Northern British Columbia in 1994 by D.F.O. statistical area. Data compiled from Sales slip database, Mark Recovery Program and Atlantic Salmon Watch program.

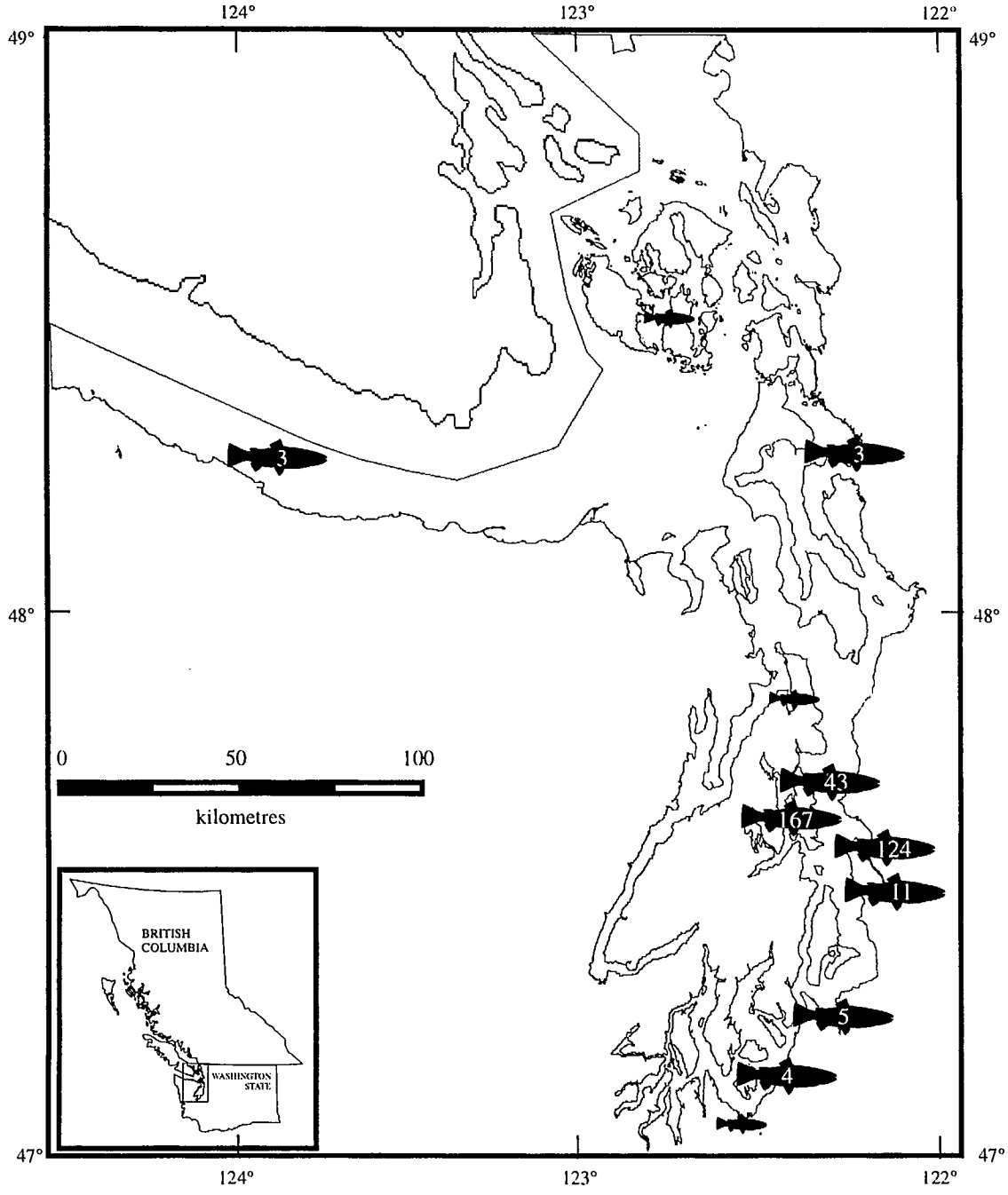


Figure 3: Catch of Atlantic salmon in Washington State in 1994, by catch region.

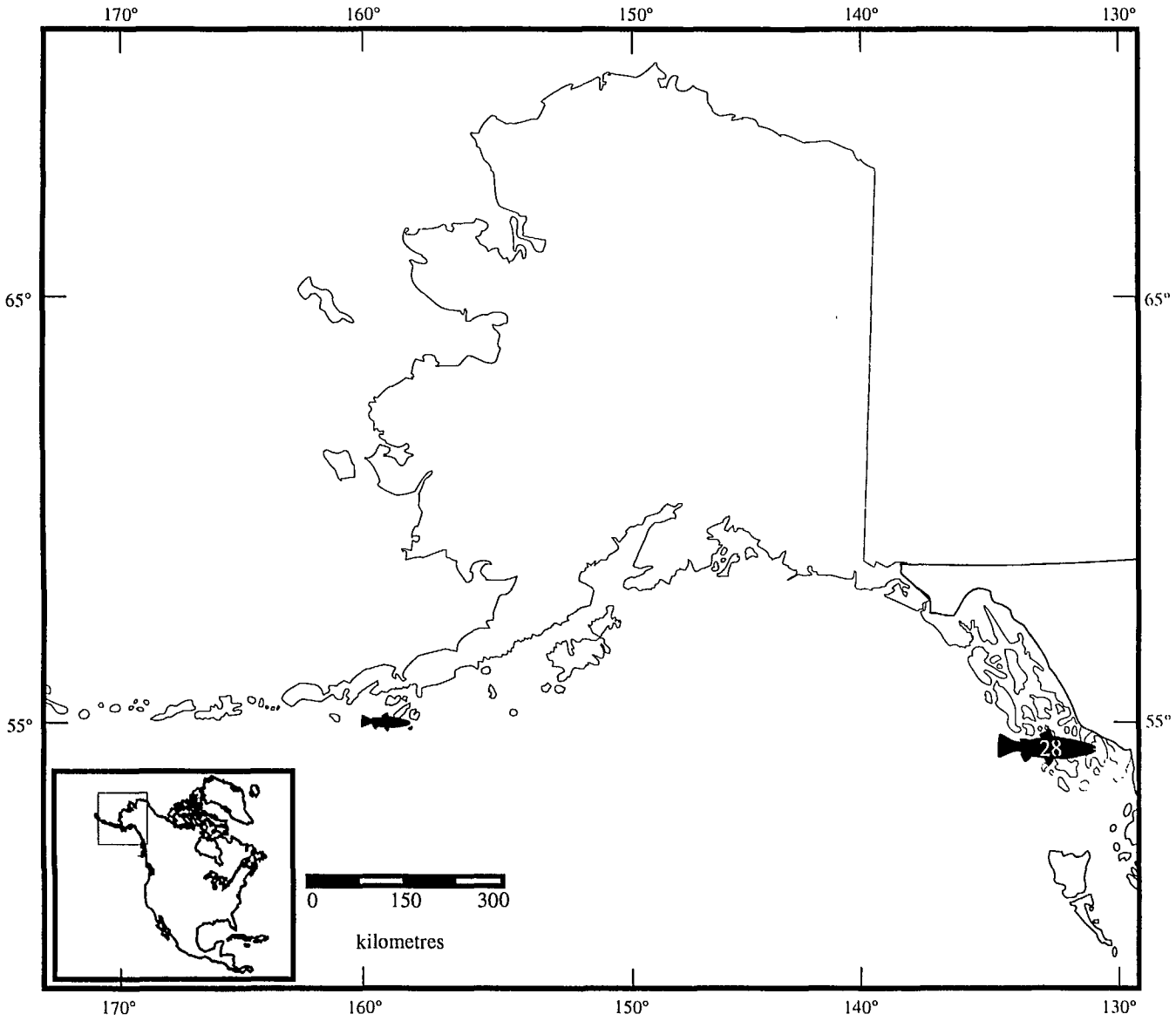
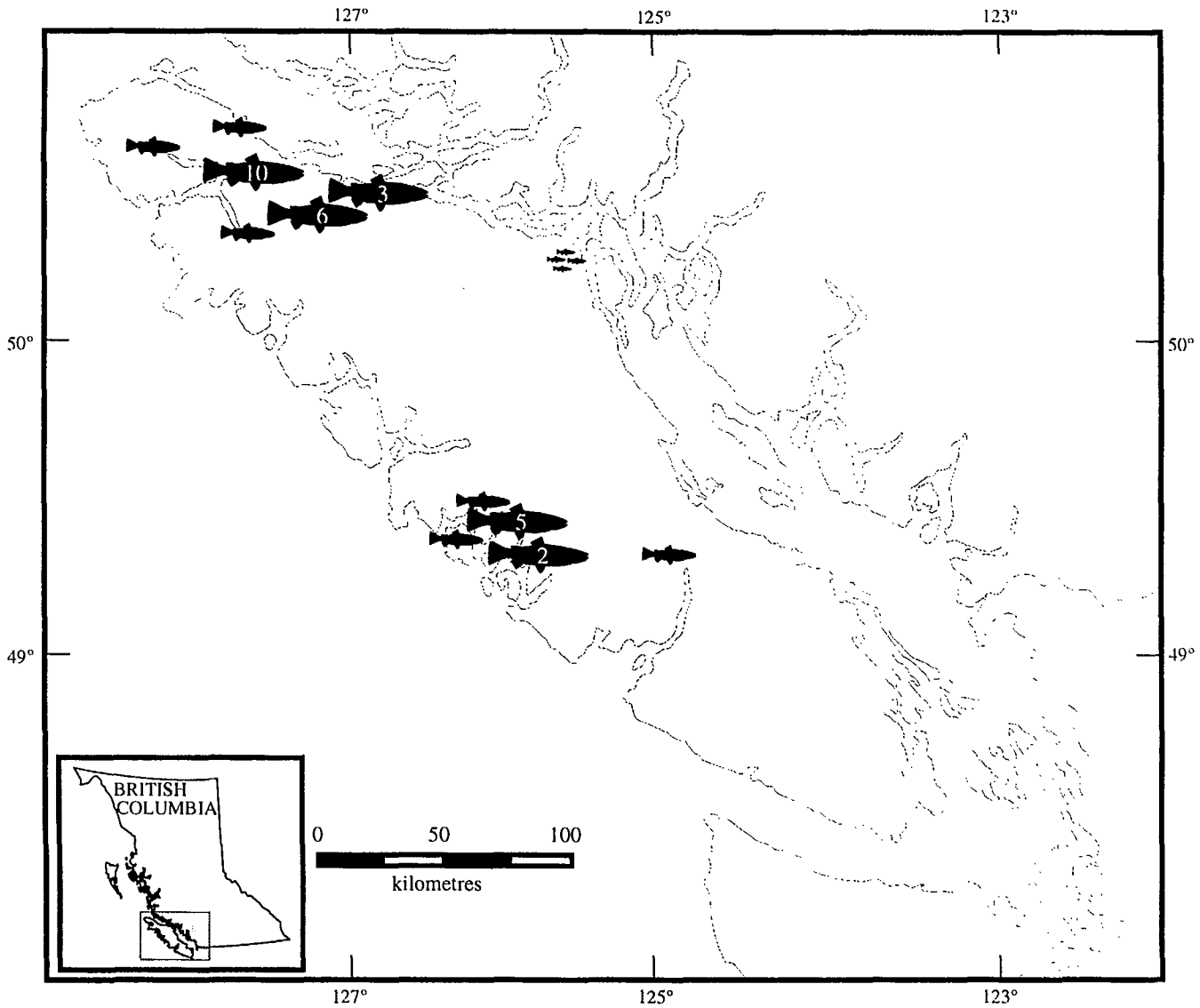


Figure 4. Atlantic salmon catch in Alaskan waters.



single reported fish.

n indicates more than one Atlantic salmon reported in a single river, where *n* is the number reported.

site of pre-smolt spill at Morstom Creek.

Figure 5. Atlantic salmon reported from freshwater sites in British Columbia in 1994. Includes fish recovered and shown in Figure 9.

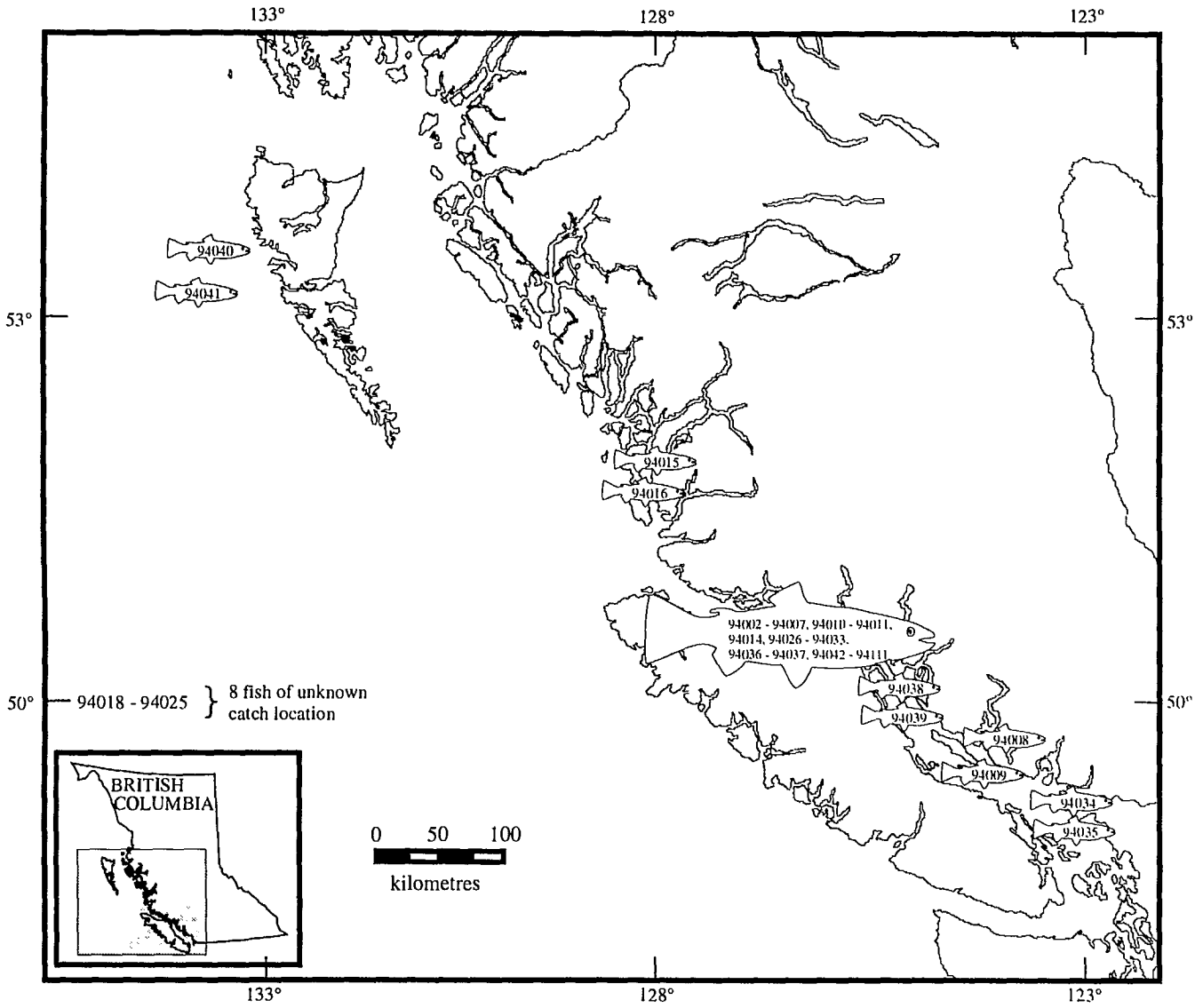


Figure 6. Atlantic salmon recovered from marine sites in British Columbia in 1994. Identified by Fish Number as listed in Table 1. Locations are by statistical and not meant to be precise catch locations.

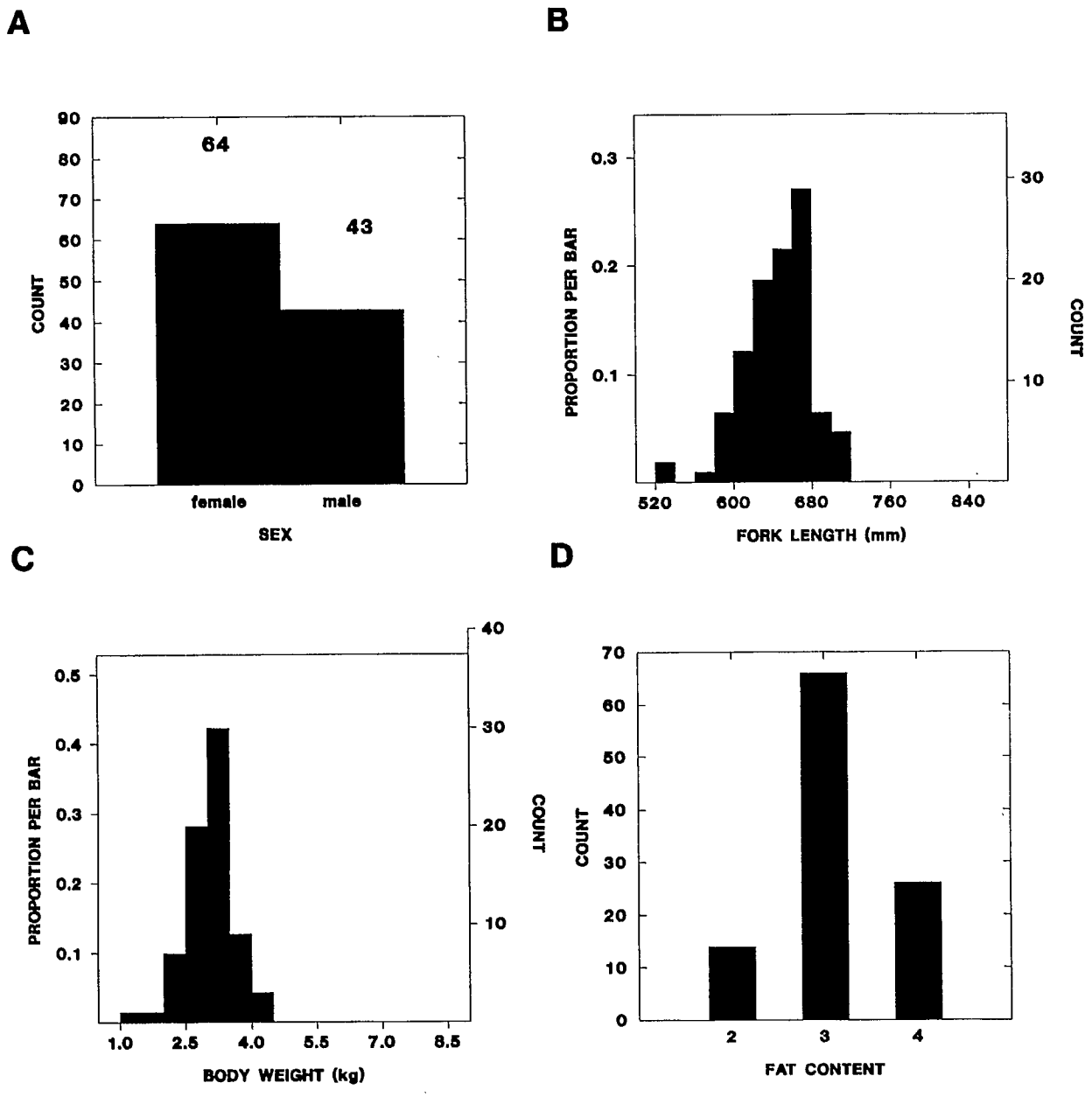


Figure 7. Biological data obtained from returned B.C. marine caught Atlantic salmon;(A) Sex ratio. (n=107) (B) fork lengths (n=107), (C) body weights (n=71),(D) Fat content (n=106).

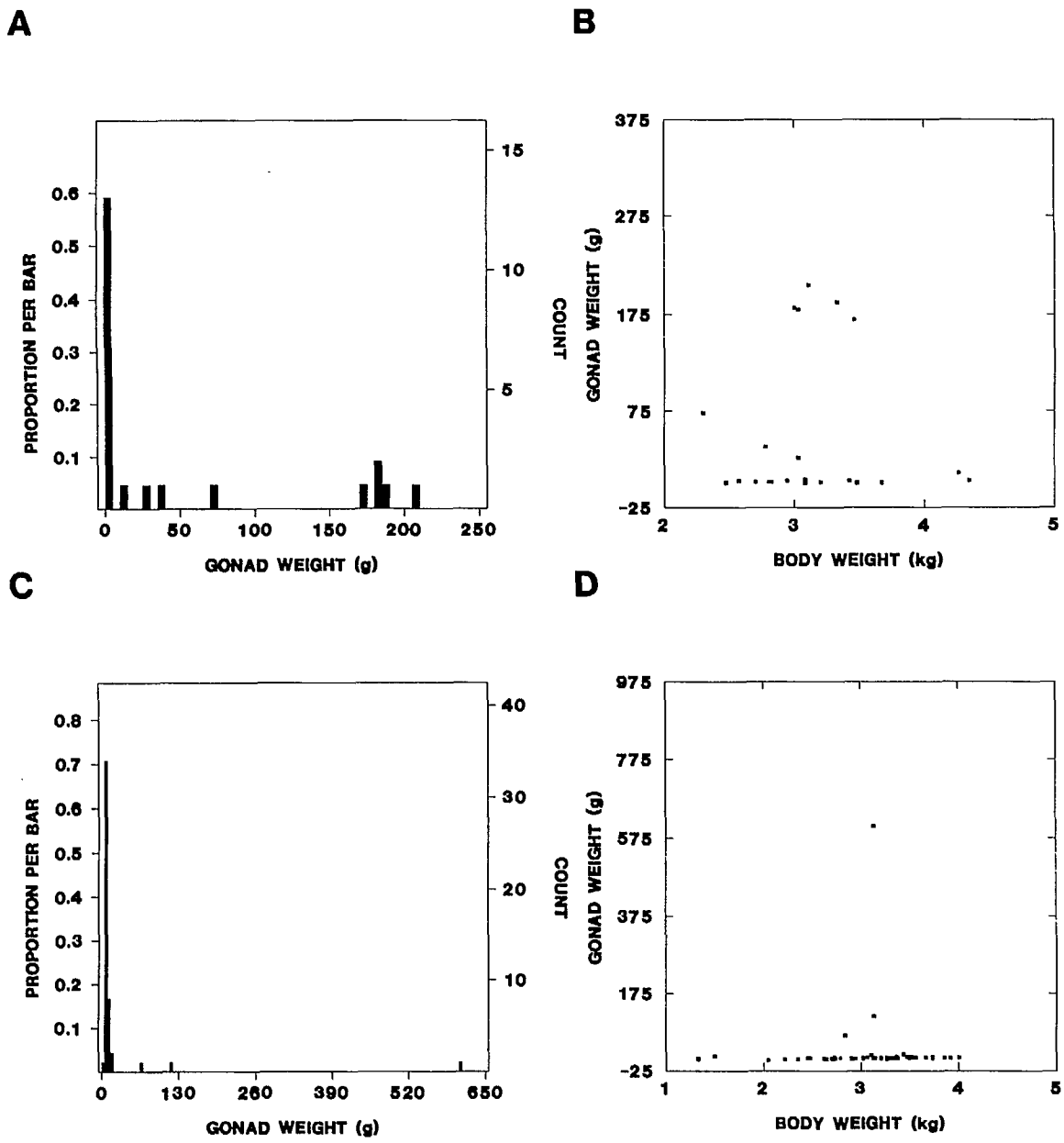
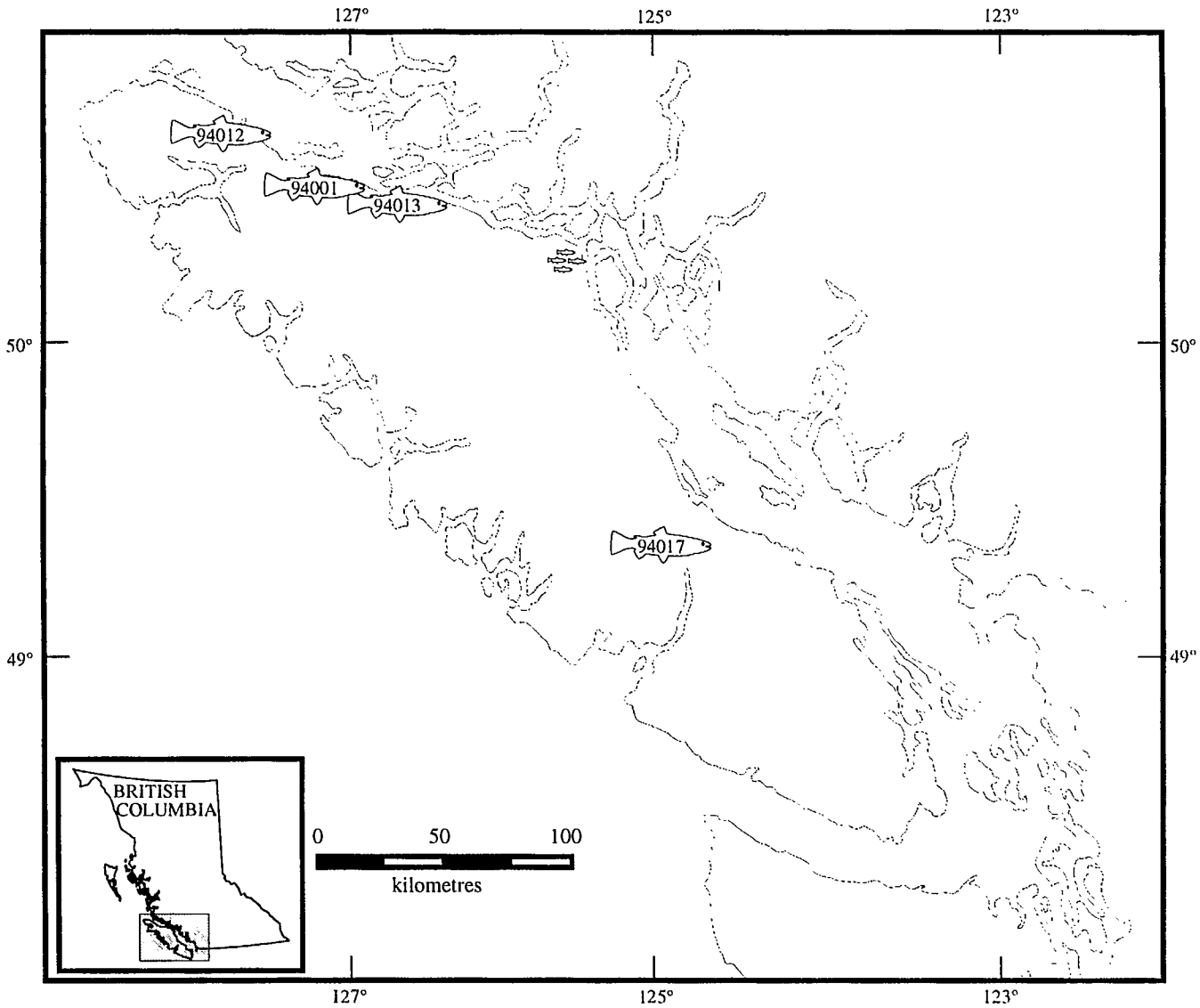


Figure 8. Biological data obtained from returned B.C. marine caught Atlantic salmon; (A) Male gonad weights (n=22), (B) Male gonad weight by body weight (n=22). (C) Female gonad weights (n=48), (D) Female gonad weight by body weight (n=48).



94nnn single recovered fish and assigned Fish No.

site of pre-smolts spilled into Morstom Creek.

Figure 9 Atlantic salmon recovered from freshwater sites in British Columbia in 1994. Recovered fish identified by Fish Number as listed in Table 2.