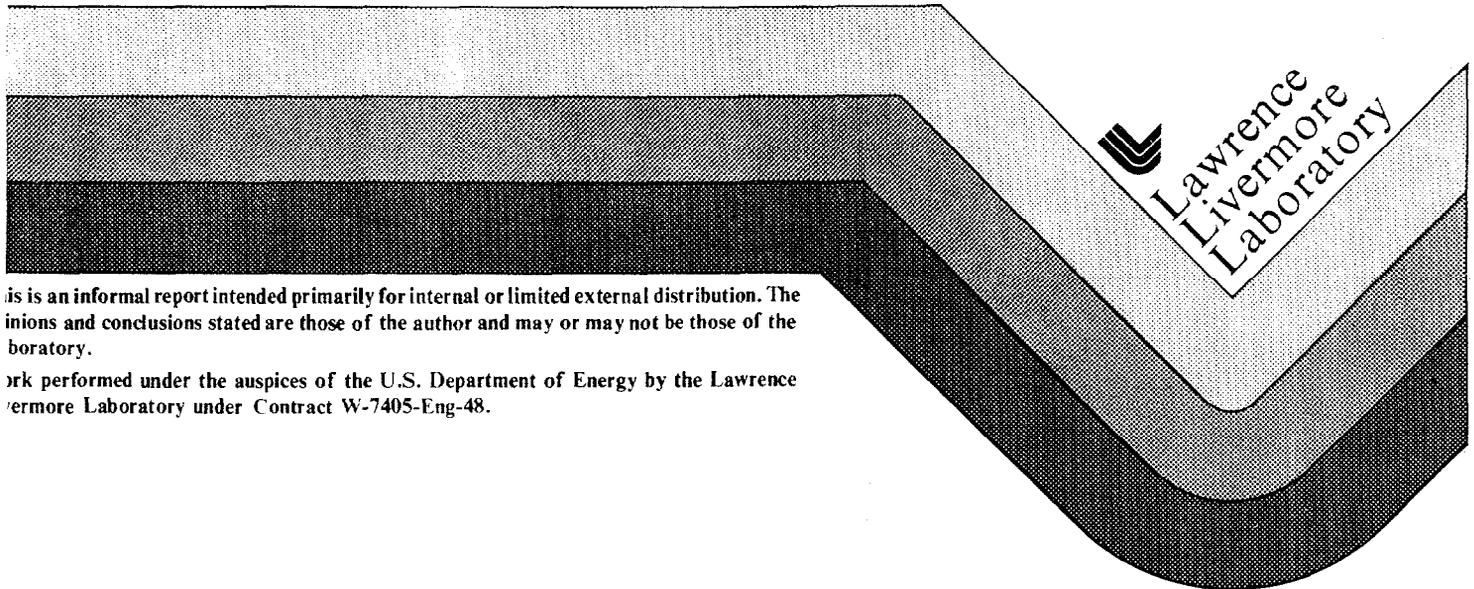


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LAGOON PELAGIC FISH FROM THE
MARSHALL ISLANDS

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1. INTRODUCTION

A radiological survey was conducted from September through November of 1978 to assess the concentrations of persistent man-made radionuclides in the terrestrial and marine environments of 11 atolls and 2 islands of the Northern Marshall Islands. The atolls and islands include Rongelap, Utirik, Taka, Bikar, Rongerik, Ailinginae, Likiep, Jemo, Ailuk, Mejet, Wotho, Ujelang and Bikini. Concentrations of radionuclides on specific islands of Bikini Atoll have been well documented.¹⁻⁴ However, little radiological information is available for the remainder of the atoll or for other atolls that were considered most likely to have received fallout from nuclear tests conducted at the Pacific Proving Grounds between 1946 and 1958.

The survey consisted, in part, of an aerial radiological reconnaissance to map the external gamma-ray exposure rates over the islands of each atoll. The logistic support for the entire survey was designed to accommodate this operation. As a secondary phase of the survey, shore parties collected appropriate terrestrial and marine samples to assess the radiological dose from pertinent food chains to individuals residing on the atolls, or who may in the future reside on some of the presently uninhabited atolls, or who may now collect food from these atolls.

Over 4000 terrestrial and marine samples were collected for radionuclide analysis from 76 different islands. Soils, vegetation, indigenous animals, and cistern and groundwater were collected from the islands. Reef fish, pelagic species, clams, lagoon water, and sediments were obtained from the lagoons.

A considerable amount of radionuclide concentration data has been generated from the analysis of these samples. Results from different phases of the program will appear in separate reports. In the first report⁵ of the UCRL Series - 52853, the general operation of the survey is described. The second report⁶ summarizes the radionuclide concentrations in cistern water and groundwater and the radiological dose assessment from ingestion of water from atoll supplies. Part 3⁷ summarizes the average concentrations measured in fish and clam muscle tissue and provides an estimate of the radiological doses via the marine food pathway.

Other reports in the series planned, include a description of our analytical quality-control program, coordinated by Dr. C. D. Jennings of the Western Oregon State College, and radionuclide concentrations in components of the terrestrial environment. Some reports will contain the analytical results and dose assessments for individual atolls while others will contain results from several atolls. In addition, some of the results are being planned for publication in international scientific journals. The final report will include assessment of the total dose from the major exposure pathways from external gamma, ingestion from food chains and inhalation.

Provided herein (except for Bikini Atoll) are all available concentration data for ^{137}Cs , ^{90}Sr , $^{239+240}\text{Pu}$, ^{238}Pu , ^{241}Am as well as naturally occurring ^{40}K and other gamma emitting radionuclides in tissues and organs of different species of fish collected from the atolls. The results in this report were used to prepare UCRL-52853, Part III. Results from Bikini Atoll will appear in a separate report.

2. FISH COLLECTIONS

a. Collection Method

Throw nets were used exclusively to catch reef fish at the atolls. Large pelagic and benthic fish were collected in the lagoons on sport fishing gear, using feathered jigs and baited hooks. The fish were returned to the research vessel, segregated by species, placed in plastic bags and frozen. The samples were shipped frozen to LLNL for storage and eventual processing.

b. Species Collected, Feeding Habits and Trophic Level Relationships

The principal species were collected based on the following reasons: they are commonly eaten by the Marshallese; relatively abundant at all atolls; have different feeding habits; and for some, represent species for which previous radiological data was available at Enewetak and Bikini for comparison. It was not always possible to obtain a sufficient number of the same species at every location because of lack of time, unavailability of a species at certain times, wrong tidal conditions for sampling, and depletion of some species from overfishing at inhabited atolls. Mullet Crenimugil crenilabis and Neomyxus chaptalii are herbivorous and detrital feeders that ingest considerable quantities of bottom sediment along with food. Convict surgeonfish Acanthurus triostegus are herbivorous browsers feeding on small algal fronds and filamentous algae that grow on reef rock or

on the base of dead coral. The unicornfish Naso lituratus, also a herbivore, browses on larger seaweed growing on sandy and rocky areas. Rabbitfish Siganus rostratus are herbivorous browsers but will occasionally feed on fleshy items found in garbage dump areas. Rudderfish Kyphosus cinerascens are strictly herbivorous browsers. All of the above fish belong to the second trophic level.⁸ Goatfish Mulloidichthys samoensis consume fossorial and other benthic fauna including small clams, crustaceans, other invertebrates, and small fish. This species belongs to the third trophic level.⁸ Threadfin Polydactylus sexfilis feed strictly on benthonic fauna and also belong to the third trophic level.⁸ Parrotfish Scarus sordidus are common reef-dwelling, grazing omnivores feeding on live coral heads and occasional algae. Parrotfish are in the fourth trophic level.⁸

Larger benthic, midwater, and surface carnivores were also occasionally collected from the lagoons. Grouper Epinephelus sp. are benthic carnivores of the third trophic level⁸ that feed on small fish and invertebrates. Jacks Caranx melampygus and Elegatis bipinnulatus (rainbow runner) are fast swimming carnivores that feed on small fish and squid. Elegatis bipinnulatus may occasionally eat swimming crustacea. Jacks are in the fourth trophic level.⁸ Snappers Aprion virescens (grey snapper) and Lutjanus bohar (red snapper) are hovering midwater-to-surface carnivores. Another snapper Letherinus kallopterus (pigfish) is a bottom dweller feeding primarily on benthonic crustacea.⁸ Tuna, Thunnus albacares, Gymnosarda nuda, Euthynnus affinis (bonito) and mackerel Grammatorcynus billineatus are large, rapid swimming carnivores feeding on small fish and any other prey of proper size. They represent species of the fifth trophic level.⁸

3. SAMPLE PROCESSING AND ANALYSIS

The fish samples from each location within an atoll were numerically counted and partially thawed in the laboratory. The total weight and standard length or fork length and sex of each fish was recorded and the average weight and length for each pooled sample was determined. Each fish was dissected into muscle tissue, bone (cranial and thoracic, vertebrae and ribs, pelvic and pectoral girdle), skin and scales (fins discarded), stomach contents, liver, and viscera. The viscera included large and small intestine with contents, stomach wall, spleen, kidney, and mesenteries. Each separate tissue and organ of the species from the same catch was pooled. Gills were separated from the fish but not analyzed. Our experience prior to 1978 showed the gills of reef fish sometimes were contaminated with sediment. Since the gills are not usually eaten and any probable contamination from occluded sediment would overshadow any useful scientific information, we excluded the gills from analysis. After the wet weight was determined, each tissue sample was dried in ovens at 90°C to constant dry weight, and dry ashed (for approximately 72 hrs.) in muffle furnaces at 450°C.

Samples were transferred to aluminum containers, sealed, and analysed by gamma spectrometry. Gamma-spectrometry measurements were made on all separated samples at Lawrence Livermore National Laboratory (LLNL) using a variety of Ge(Li)-diode detector systems. Counting times were usually 1000 minutes or longer for each sample. A general-purpose computer program called GAMANAL was used for the data reduction of all generated spectra. The program searches a library of long-lived products of nuclear explosions, activation products and naturally occurring radionuclides in order to identify radionuclides from any observed photopeak in the gamma spectra. It also

generates an upper-limit amount of specific radionuclides based on those spectra regions where signals would be seen if the radionuclides were present in detectable quantities. A more complete description of the gamma equipment used, calibration, sensitivity of detection, uncertainties and methods for setting upper limits is given in NVO-140.⁹

After gamma analysis the samples were either sent to a contractor laboratory or retained at LLNL for radiochemical separations of $^{238,239,240}\text{Pu}$, ^{241}Am , ^{90}Sr and ^{137}Cs . Except for ^{137}Cs , these are nuclides that can not be detected by gamma spectrometry and that are judged to be of potential significance for the dose assessment. ^{137}Cs was radiochemically separated from muscle tissue and analyzed to confirm the measurements made by gamma spectrometry which in turn provided a useful inter-laboratory calibration for quality control based on identification of a radionuclide by two independent analytical methods. Separation techniques used at LLNL are published¹⁰ and those used by the contractor lab are summarized in NVO-140.⁹ A number of coded duplicates, blanks and standard samples were included with the regular samples analyzed at LLNL and at the contractor laboratory. All available quality control results for the marine samples demonstrated that the analytical performance was extremely good. A full discussion of all the quality control data for the 1978 survey results is in preparation.¹¹

4. RESULTS

The percentages of organ or tissue to whole body fresh weight were determined for several species indigenous to the atolls and are given in Table 1. This table, along with the radionuclide concentrations, permits one to calculate concentrations in any desired assemblage of fish tissues. In Tables 2-25, pertinent collection information (such as: islands sampled at each atoll, names of fish, numbers of male and females pooled per sample, average whole body weights and standard lengths) is first tabulated for each atoll and then followed by a table of the radionuclide concentrations in the separated tissues and organs. The data are arranged by atoll in alphabetical order. The location of the island sampled within an atoll (island locator number) can be found by referring to the maps of the atolls provided in UCRL-52853, Part 1.⁵

Estimated maximum whole body dose rates computed from these results for individuals consuming 200 grams of fish flesh daily range from 0.028 mrem/yr at Mejit to about 0.1 mrem/yr at Rongelap; the bone marrow dose rate range from 0.024 at Mejit to 0.12 mrem/yr at Rongelap⁷. These annual dose rates can be compared for perspective to the current U.S. Federal guidelines for whole body and bone marrow of 500 mrem/yr for an individual and 170 mrem/yr for a population average.

5. DISCUSSION

Radionuclide concentrations in muscle tissue are summarized in Tables 26 and 27 from the results in Tables 2-25 to show average concentration in the different fish species from each atoll. Inspection of these tables shows that concentrations of ^{90}Sr in muscle tissue are very low (for the most part being undetectable in many of the samples analyzed) and that there is little difference in the average concentration in muscle from the different fish from all atolls. This is not the case for ^{137}Cs and $^{239+240}\text{Pu}$. Concentrations of $^{239+240}\text{Pu}$ in second trophic level species (mullet and surgeonfish) from Rongelap also differ significantly from concentrations in these species from the other atolls.

At all atolls the muscle tissue of all reef species contain higher concentrations of $^{239+240}\text{Pu}$ than the amounts found associated with muscle from pelagic lagoon fish. The regularities and differences that the results provide with respect to tissue distributions, trophic level relationships, feeding habits and environmental concentrations of the transuranics has been discussed.¹² The food chain behavior of $^{239+240}\text{Pu}$ does not parallel that of ^{137}Cs . Where the flesh of mullet are found to have highest levels of Pu among all species analyzed, ^{137}Cs concentrations are lowest in the flesh of the bottom feeding fish such as mullet and goatfish at all atolls. Also unlike $^{239+240}\text{Pu}$, highest average concentrations of ^{137}Cs are found in the muscle of the pelagic fish. A full discussion of the ^{137}Cs concentrations

in fish and how these relate to environmental and biological factors is in preparation. It is sufficient to point out herein that ^{137}Cs and $^{239+240}\text{Pu}$ is accumulated in higher concentrations in some species than in others and this observation relates to the capacity individual species of fish have to accumulate these radionuclides from the environment.

Recent measurements of radionuclide concentrations in fish flesh and other marine dietary items from a variety of national and international sources are summarized in Tables 28 and 29. Several obvious generalizations can be made by comparing these independent results to the analysis of fish flesh concentrations from the Marshall Islands. The average concentrations of ^{90}Sr in the flesh of any species from the atolls fall within the range of concentrations found in fish typically consumed as food in the United States and Japan.

The ^{90}Sr is approximately 2 to 3 times less in fish from the atolls than the average ^{90}Sr concentration found in fish products imported to the United States for consumption. Average ^{137}Cs concentrations shown in Tables 26 and 27 are also within the range of levels associated with U.S. dietary marine foods and are significantly less than concentrations encountered with many commercial fish consumed in the United Kingdom. Except at Rongelap, concentrations of ^{137}Cs in mullet are generally lower than the concentration presently detected in the flesh of another species of mullet from the east coast of the United States. Except for the second trophic level fish from Rongelap, $^{239+240}\text{Pu}$ levels in fish are also comparable to concentrations in

similar types of species consumed in the United States. Concentrations in mullet and surgeonfish from Rongelap are lower than average levels in pelagic fish consumed in the United Kingdom.

Plutonium and americium concentrations are somewhat higher in the flesh of fish collected at some atolls than levels expected in muscle tissue of fish feeding in global fallout contaminated environments. The source of these radionuclides, in addition to global fallout, is the residual material which was deposited in the lagoon sediments during the test years. The transuranics are now remobilized to the water column and entering the marine food chains.¹² However, the estimated doses from Pu and Am are a very small fraction of the estimated total doses via the marine pathway which in turn are only a small fraction of the current guidelines.⁷

An individual in the United States consuming 200 gms of marine fish per day (the consumption rate used for dose computations in the Marshall Islands) containing radionuclide concentrations typically found in the U.S. marine dietary items, would receive a radiological dose very similar to the dose for residents at Rongelap, Utirik, Ailuk, Likiep, Mejit, Wotho and Ujelang from the marine food chain.

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TABLE 1. % of Whole Body Weight of Tissues and Organs for Specific Fish Analyzed

Name	Muscle	Bone	Stomach Contents	Viscera	Scales & skin	Liver	Gill	Reproductive Organs		
								Ovary	Testes	Eyes
<u>Acanthurus triostegus</u> (Surgeonfish)	66.3	8.0	0.7	6.5	11.6	0.7	1.6	1.5	1.1	1.2
<u>Crenimugil crenilabris</u> (Mullet)	58.9	6.9	0.7	13.6	14.1	0.9	1.8	1.0	1.8	1.2
<u>Neomyxus chaptaliai</u> (Mullet)	55.3	5.5	0.7	17.9	14.1	1.7	1.4	2.4	1.2	0.7
<u>Mulloidichthys samoensis</u> (Goatfish)	66.3	8.0	.08	6.5	11.6	0.41				2.6
<u>Aprion virescens</u> (Snapper)	76.7	9.1	.03	1.8	9.3	0.5	0.7	--0.23--		1.6
Mean % (all fish)	65	7.5	0.4	9.3	12.1	0.8	1.4	1.3	1.1	1.8

Island Locator	Common Name	Scientific Name	Number of Individuals Pooled/ Sample	Average Whole Body Wet Weight (gm)	Average Standard Length (mm)	Male	Female
A-11	Surgeonfish	<u>Acanthurus triostegus</u>	24	40±9	95±13	9	15
A-1	Surgeonfish	<u>Acanthurus triostegus</u>	17	38±10	95±7	14	3
A-1	Mullet	<u>Crenimugil crenilabis</u>	7	164±91	186±29	5	2
A-11	Mullet	<u>Crenimugil crenilabis</u>	18	434±80	272±20	2	16
A-53	Mullet	<u>Crenimugil crenilabis</u>	7	266±270	198±86	5	2
A-53	Goatfish	<u>Mulloidichthys samoensis</u>	23	189±43	206±10	17	6
A-20	Goatfish	<u>Mulloidichthys samoensis</u>	31	45±5	133±15	23	8
A-11	Goatfish	<u>Mulloidichthys samoensis</u>	45	171±37	202±20	30	15
Lagoon	Mackerel	<u>Grammatorcynus bilineatus</u>	1	629	400	0	1

TABLE 3. Concentrations of Radionuclides in Fish Tissue - Ailuk Atoll
pCi/kg wet weight

Sample Island ID	locator	Tissue	Dry/wet weight	^{40}K $\times 10^{-3}$	^{137}Cs	^{90}Sr	$^{239+240}\text{Pu}$	^{238}Pu $\frac{238\text{Pu}}{239+240\text{Pu}}$	^{241}Am $\frac{241\text{Am}}{239+240\text{Pu}}$	Others
Name: Surgeonfish										
6700	A-11	muscle	0.216		10 1(5)	<0.7	<.03	--	<.2	
6701		bone	0.573	1.07(27)	<14	19.7(11)	1.4(26)	<.05	.46(60)	
6702		stomach contents	0.143	--	<70	--	--		lost	
6703		viscera	0.166	3.22(6)	18.7(26)	4.0(45)	1.9(13)	.17(40)	<.1	
6704		skin	0.377	3.77(5)	23.1(29)	<3	0.6(30)			
6705		liver	0.218	3.90(26)	<50					
6706	A-1	muscle	0.221	3.78(3)	20.3(22)	<1	.08(75)	<.02	<.2	
6707		bone	0.559	0.69(27)	<11	22(18)	5.2(15)		<.03	
6708		stomach contents	0.103	--	<29	--				
6709		viscera	0.139	3.26(3)	19.3(17)	7.3(35)	3.5(13)	.14(40)	.29(35)	144Ce 74(28) 60Co9(78)
6710		skin	0.413	4.96(6)	30(37)	10(30)	3.7(14)	.20(30)	0.4(70)	
6711		liver	0.215	--	<55					
Name: Mullet <u>Crenimugil</u>										
6712	A-1	muscle	0.219	3.66(2)	7.7(23)		0.035(27)		<.3	
6713		bone	0.556	0.96(18)	<10		3.33(8)			
6714		stomach contents	0.608	--	<45		10.9(7)		<.6	144Ce 250(13)
6715		viscera	0.358	2.11(6)	<5		1.1(10)			
6716		skin	0.587	3.87(6)	<8		24.6(7)		<.7	
6717		liver	0.195	3.12(29)	<43					
6718	A-11	muscle	0.239	3.63(1)	7.9(8)		.079(10)			
6719		bone	0.652	0.85(14)	<6		3.84(5)			
6720		stomach contents	0.045	--	<32		0.22(7)			
6721		viscera	0.309	2.91(2)	5.4(20)		2.19(3)		0.08	60Co 16(14)
6722		skin	0.608	2.88(4)	<5		1.52(11)			60Co 49(14)
6723		liver	0.246	3.5(32)	8.9(44)					
6724	A-53	muscle	0.224	3.45(2)	5.87(5)	<0.4	.082(30)		<0.1	
6725		bone	0.666	--	<11	23(10)	5.1(8)	.05(60)	0.73(35)	
6726		stomach contents	0.548	1.23(26)	<15	61(18)	17.1(14)	.16(40)	1.0(15)	144Ce 735(17)
6727		viscera	0.348	1.74(4)	<3	15(15)	11.1(4)	.018(10)	0.77(15)	144Ce 373(7)
6728		skin	0.589	2.57(6)	<7	3(95)	2.2(11)	<.01		
6729		liver	0.214	2.37(21)	<26					
Name: Goatfish										
6730	A-53	muscle	0.228	4.31(2)	7.20(2)	0.23(20)	<.002	--	<.1	
6731		bone	0.581	0.85(6)	<3	90(5)	<.11	--	<.1	
6732		stomach contents	0.155	5.67(20)	<60					
6733		viscera	0.270	4.20(2)	7(35)	2.9(32)	0.32(32)	--		60Co 12(37)
6734		skin	0.557	3.41(3)	<4	3.4(60)	<.04	--		
6735		liver	0.245	5.49(7)	<12					

TABLE 3. (Continued) Concentrations of Radionuclides in Fish Tissue - Ailuk Atoll
pCi/kg wet weight

Sample Island	Dry/wet weight x 10 ⁻³	⁴⁰ K	¹³⁷ Cs	⁹⁰ Sr	²³⁹⁺²⁴⁰ Pu	²³⁸ Pu ²³⁹⁺²⁴⁰ Pu	²⁴¹ Am ²³⁹⁺²⁴⁰ Pu	Others
Name: Goatfish (continued)								
6736	0.223	4.45(1)	5.73(5)	<0.5	<.01	--	<1	
6737	0.514	0.58(22)	<6	42.6(7)	<.03	--	<1	
6738	lost							
6739	stomach contents							
6740	viscera	2.10(19)	<14	<6	<.3	--	--	
6741	skin	5.06(4)	<9	5.6(37)	<.09	--	<1	
6741	liver	5.51(11)	<22					
6742	muscle	3.84(2)	6.21(3)	<.07	<.002	--	<1	
6743	bone	0.52(8)	<3	21.6(4)	0.13(34)	<.06	.31(70)	
6744	stomach contents	0.149	<36					
6745	viscera	3.87(4)	9.3(28)	2.6(45)	0.92(11)	.06(70)	.64(23)	
6746	skin	3.24(3)	<3	7.4(15)	<.009	--	<1	
6747	liver	4.84(7)	<8					
Name: Mackerel								
6748	muscle	0.231	5.08(2)	<0.7	<.02	--	<1	
6749	bone	0.477	1.10(25)	<8	<.2	--	<1	
6750	stomach contents	lost						
6751	viscera	0.246	3.25(13)	44(42)				
6752	skin	0.367	4.19(8)	<16				
6753	liver	0.282	6.00(22)	<61				

a - Value in parenthesis in this and in subsequent tables is the percent standard deviation of the counting error.

TABLE 4. Fish Collections - Ailinganae Atoll

Island Locator	Common Name	Scientific Name	Number of Individuals Pooled/Sample	Average Whole Body Wet Weight (gm)	Average Standard Length (mm)	Male	Female
C-5	Surgeonfish	<u>Acanthurus triostegus</u>	16	75±20	118±12	8	8
C-19	Surgeonfish	<u>Acanthurus triostegus</u>	26	33±11	90±13	21	5
C-24	Surgeonfish	<u>Acanthurus triostegus</u>	26	47±23	97±17	18	8
C-27	Surgeonfish	<u>Acanthurus triostegus</u>	73	53±19	100±12	51	22
C-5	Mullet	<u>Crenimugil crenilabis</u>	5	257±41	410±175	3	2
C-19	Mullet	<u>Crenimugil crenilabis</u>	14	395±132	257±35	9	5
C-27	Mullet	<u>Crenimugil crenilabis</u>	3	520±69	278±19	1	2
C-27	Mullet	<u>Neomyxus chaptalli</u>	14	129±62	179±32	12	2
C-5	Goatfish	<u>Mulloidichthys samoensis</u>	28	163±51	199±18	21	7
C-15	Goatfish	<u>Mulloidichthys samoensis</u>	64	66±12	145±15	43	21
C-24	Parrotfish	<u>Scarus sordidus</u>	9	630±74	274±18	1	8
Lagoon	Rainbow Runner	<u>Elagatis sp.</u>	1	2642	615	1	0
Lagoon	Mackerel	<u>Grammatocynus bilineatus</u>	1	1041	475	0	1
C-24	Grouper	<u>Epinephelus sp.</u>	1	1832	490	0	1
C-24	Snapper	<u>Lethrinus kallopterus</u>	2	2017±372	510±28	2	0

TABLE 5. Concentrations of Radionuclides in Fish Tissue nganae Atoll
pCi/kg wet weight

Sample Island	Dry/wet	40K	137Cs	90Sr	239+240Pu	238Pu	241Am	Others
ID locator	Tissue	Weight x10 ⁻³						
Name: Surgeonfish								
6479	C-5 muscle	0.217	4.28(3)	19.9(3)	1.1(44)	.19(20)	<0.3	
6480	bone	0.559	0.53(27)	<9	103(12)	19.6(7)	<.01	
6481	stomach contents	0.082	2.05(15)	<19				
6482	viscera	0.124	1.87(6)	13(40)	4.7(14)	14.7(5)	.17(14)	
6483	skin	0.337	3.01(5)	<10	13.5(17)	8.4(11)	.036(15)	
6484	liver	0.247	3.1(40)	<60				
6495	C-19 muscle	0.209	3.89(2)	20.0(5)	<1	0.13(57)	<.5	
6496	bone	0.589	--	<10	10(49)	21.6(7)	.054(28)	
6497	stomach contents	0.161	--	<200				
6498	viscera	0.164	1.79(13)	<9	4.8(26)	9.13(7)	.19(14)	
6499	skin	0.331	3.03(8)	<7	6.7(33)	11.6(9)	.063(30)	
6500	liver	0.257	--	<44				
6507	C-24 muscle	0.213	4.83(1)	28.2(4)	.72(36)	.05(75)	<.2	
6508	bone	0.611	0.38(37)	<8	30.4(5)	15.8(5)	.012(37)	
6509	stomach contents	0.112	1.90(29)	<35				
6510	viscera	0.127	2.24(4)	<3	2.89(16)	13.1(5)	.072(17)	144Ce 49(32)
6511	skin	0.319	3.28(3)	<16	2.39(42)	7.9(5)	.058(30)	
6512	liver	0.266	3.10(22)	<35				
6485	C-27 muscle	0.214	3.55(1)	24.5(2)	0.23(51)	0.11(2)	<0.1	
6486	bone	0.524	0.31(20)	<3	17.1(5)	7.7	.028(32)	.009(30)
6487	stomach contents	0.127	2.21(13)	<14	17.1(2)	5.34(12)	.06(80)	.46(25)
6488	viscera	0.125	2.10(4)	5.3(32)	20.3(21)	9.81(7)	.013(75)	.087(20)
6489	skin	0.334	3.08(2)	19.8(11)	4.3(20)	7.95(6)	.047(29)	.049(20)
6490	liver	0.260	3.17(9)	<20				
Name: Mullet Crenimugil								
6501	C-5 muscle	0.221	3.73(4)	13.9(8)		0.14(7)		
6502	bone	0.634	0.70(18)	<8		13.9(6)		
6503	stomach contents	0.647	4.54(26)	<65		237(2)		
6504	viscera	0.383	2.13(5)	<15		97(2)		0.56(4)
6505	skin	0.433	2.44(6)	<6		3.94(4)		
6506	liver	0.205	2.46(16)	<29		117(7)		0.05(60)
6525	C-19 muscle	0.221	3.77(1)	11.3(2)	<0.2	0.17(13)	.05(75)	<.04
6526	bone	0.634	0.67(11)	<4				
6527	stomach contents							
6528	viscera	0.253	2.83(8)	<2	6.5(9)	12.0(4)	.010(33)	60Co 6(62)
6529	skin	0.464	2.36(3)	<2	13.2(5)	3.2(8)	.034(53)	.005(85)
6530	liver	0.225	3.05(6)	<9				60Co 123(8)

TABLE 5. (Continued) Concentrations of Radionuclides in Fish Tissue Ailinganae Atoll
pCi/kg wet weight

Sample Island ID	locator	Tissue	Dry/wet Weight x10 ⁻³	¹³⁷ Cs	⁹⁰ Sr	²³⁹⁺²⁴⁰ Pu	²³⁸ Pu	²⁴¹ Am	Others
						$\frac{239+240}{Pu}$	$\frac{238}{Pu}$	$\frac{241}{239+240}$	
Name: Mullet <u>Crenimugil</u> (continued)									
6513	C-27	muscle	0.227	6.51(10)	<0.5	<.02	<.1	<.1	
6514		bone	0.579	<12	27(11)	16.8(7)	.046(38)	.08(.17)	
6515		stomach contents	0.610	<63	123(12)	56.4(8)	.037(50)	.83(.2)	
6516		viscera	0.431	<6	57(4)	34.5(3)	.012(15)	.22(.0)	144Ce 299(13)
6517		skin	0.522	<5	11(16)	4.5(9)	.036(67)	.049(.32)	
6518		liver	0.250	<21					
Name: Mullet <u>Neomyxus</u>									
6513	C-27	muscle	0.227	5.8(7)	<0.6	0.28(20)	.27(60)	.07(90)	
6514		bone	0.579	<9	13.9(12)	4.86(12)	<.03	<.02	
6515		stomach contents	0.610	<48	66.5(15)	37.8(9)	.09(35)	.61(10)	
6516		viscera	0.431	<5	22.7(11)	16.1(5)	.029(30)	.47(10)	144Ce 401(8)
6517		skin	0.522	<5	<2	2.4(19)	.18(60)	1-est	
6518		liver	0.250	<26					
Name: Goatfish									
6531	C-5	muscle	0.224	7.2 (4)	0.22(70)	.016(75)	<.1	<.1	
6532		bone	0.565	<5	35(11)	.035(34)	<.1	<.1	
6533		stomach contents	0.305	<47					
6534		viscera	0.297	<7	<8	5.53 (8)	<.2	.14(20)	60Co 16(40)
6535		skin	0.429	14(15)	12.9(7)	<.01	<.1	<.1	60Co 3(60)
6536		liver	0.232	<19					60Co 85(24)
6537	C-15	muscle	0.226	6.9(3)	0.40(39)	<.03	<.1	<.1	
6538		bone	0.498	<6	67(8)	<.07	<.1	<.1	
6539		stomach contents	0.486	<115					
6540		viscera	0.251	9.3(29)	7.9(24)	1.4(20)	<.1	.5(70)	60Co 39(10)
6541		skin	0.417	8.6(42)	12.0(8)	<.02	<.1	<.1	
6542		liver	0.248	<32					
Name: Parrotfish									
6543	C-24	muscle	0.216	18.1(3)	.20(56)	.065(16)	<.2	<.03	
6544		bone	0.570	1.1(44)	25.3(7)	7.4(7)	.026(37)	.062(22)	
6545		stomach contents	0.403	<20	44(26)	33.5(7)	<.02	.55(12)	
6546		viscera	0.450	<2	34(4)	31.8(4)	.004(50)	.041(13)	144Ce 249(11)
6547		skin	0.401	10(24)	7.9(7)	3.67(6)	.022(35)	.023(46)	
6548		liver	0.289	<4					

Table 5. (Continued) Concentrations of Radionuclides in Fish Tissue - Ailinganae Atoll
pCi/kg wet weight

Sample Island in locator	Tissue	Dry/wet Weight	40K x10 ⁻³	137Cs	90Sr	239+240Pu	238Pu 239+240Pu	241Am 239+240Pu	Others
Name: Rainbow Runner									
6561	Lagoon muscle	0.271	3.81(1)	14.3(3)	<0.2	<.008	<1	<1	
6562	bone	0.623	0.72(12)	<4		<.09	<1	<1	
6563	stomach contents	0.227	2.50(5)	14.6(31)					
6564	viscera	0.371	3.10(4)	35(12)					
6565	skin	0.505	2.57(6)	<7	<9	<.10	<1	<1	
6566	liver	0.290	9.76(7)	<35					
Name: Mackerel									
6549	Lagoon muscle	0.236	5.18(2)	21.4(2)	<0.5	.02(75)	<1	<1	
6550	bone	0.546	0.53(28)	<4	22(24)	<.03	<1	<1	60Co 299(44) 60Co 47(74)
6551	stomach contents	0.268	---	<100					
6552	viscera	0.256	3.62(11)	<10					
6553	skin	0.353	3.52(11)	<5					
6554	liver	0.275	3.58(31)	<25					
Name: Grouper									
6567	Lagoon muscle	0.215	4.64(3)	35.9(3)	<0.5	<.01	<1	<1	
6568	bone	0.661	---	<5	22(24)	<.06	<1	<1	
6569	stomach contents	0.187	---	<200					
6570	viscera	0.210	2.47(27)	33(28)					
6571	skin	0.352	3.23(4)	16(31)		.22(75)	<1	<0.2	
6572	liver	0.224	3.19(20)	<33					
Name: Snapper									
6555	C-24 muscle	0.218	4.39(1)	18.9(3)	<0.2	<.01	<1	<1	
6556	bone	0.574	0.51(11)	<3	17(8)	.23(27)	<.1	.6(50)	
6557	stomach contents	0.145	2.50(40)	<65					
6558	viscera	0.229	2.77(7)	<18					
6559	skin	0.416	3.07(3)	14(25)	6.2(32)	<.09	<1	<1	60Co 68(20) 60Co 11(41) 60Co 261(8)
6560	liver	0.254	2.24(15)	<20					

TABLE 6. Fish Collections - Bikar Ato1

Island Locator	Common Name	Scientific Name	Number of Individuals Pooled/ Sample	Average Whole Body Wet Weight (gm)	Average Standard Length (mm)	Male	Female
D-1	Surgeonfish	<u>Acanthurus triostegus</u>	7	119±17	137±6	4	3
D-4	Surgeonfish	<u>Acanthurus triostegus</u>	55	57±11	103±10	34	21
D-1	Mullet	<u>Crenimugil crenilabris</u>	3	691±117	312±18	0	3
D-1	Mullet	<u>Neomyxus chaptallii</u>	7	197±50	198±56	1	6
D-4	Mullet	<u>Neomyxus chaptallii</u>	60	75±16	150±12	52	8
D-1	Parrotfish	<u>Scarus sordidus</u>	2	578±216	260±30	1	1
D-4	Parrotfish	<u>Scarus sordidus</u>	6	206±24	174±10	1	5
Lagoon	Ulua	<u>Caranx sp.</u>	2	2105±435	485±42	1	1
Lagoon	Ulua	<u>Caranx sp.</u>	2	1440±590	421±72	2	0

Name:	Surgeont fish	Muscle	Bone	Stomach contents	Viscera	Skin	Liver	U.S.	Sr	239+240 Pu	238Pu	241Am	Others
											239+240 Pu	239+240 Pu	
6670	D-1	muscle	0.214	22.5(4)	<1	39(29)	0.67(4)	<1	<1	<0.2	<0.2		
6671		bone	0.614	<11	<88	14(18)	7.5(11)	35(4)					60Co 190(50)
6672		stomach contents	0.248	9(40)	9(40)	3.1(12)	1.4	5.8(17)					60Co 18(20) 144Ce 133(22)
6673		viscera	0.177	3.06(6)	<9	<61	3.1(9)	6.3(15)					
6674		skin	0.383	3.73(2)	21.1(3)	<0.3	<.006	<0.3					
6675		liver	0.238	0.40(38)	<8	35(4)	0.60(13)	5.8(17)					144Ce 250(35)
6664	D-4	muscle	0.213	2.23(4)	8.3(34)	5.8(17)	5.8(5)	6.3(15)					144Ce 125(18)
6665		bone	0.604	2.23(4)	21(16)	1.3(9)	3.18(3)	1.3(9)					
6666		stomach contents	0.107	3.15(10)	<16		0.25(30)	0.036(60)					
6667		viscera	0.137										
6668		skin	0.358										
6669		liver	0.225										
Name: Mullet Crenimugil													
6646	D-1	muscle	0.238	<45	<3	<7	2.27(4)	2.19(7)	2.74(12)	<15	1.28(6)	0.02(50)	60Co 10(37)
6647		bone	0.586	2.27(4)	2.19(7)	<7	265(3)	28.3(2)	0.36(14)	0.57(3)	0.13(25)	0.0039(21)	60Co 7(37)
6648		stomach contents	0.530	2.74(12)	<15		9.1(6)	9.1(6)		1.3(53)	0.11(50)	<.01	60Co 137(14) 113mCd 76(12)
6649		viscera	0.372										
6650		skin	0.512										
6651		liver	0.253										
Name: Mullet Neomyxus													
6676	D-1	muscle	0.246	3.37(1)	6.2(14)	0.2(65)	0.32(30)	1.07(15)	<.032(30)	<.2	<.2		
6677		bone	0.595	3.37(1)	6.2(14)	29(11)	76(3)	8.25(2)	0.40(23)	0.50(13)	0.004(50)	0.009(30)	
6678		stomach contents	0.543	3.52(25)	<49	37(5)	8.25(2)	0.40(23)	<.04(55)	<.6	<.6		113mCd 68(15)
6679		viscera	0.494	1.53(6)	<4	7.8(12)	9.37(7)	9.37(7)					
6680		skin	0.569	2.50(6)	<7								
6681		liver	0.284	2.38(15)	<16								
6652	D-4	muscle	0.212	2.91(1)	5.7(3)	0.2(65)	lost	lost	lost	lost	lost	lost	
6653		bone	0.515	2.91(1)	5.7(3)	29(11)	1.97(13)	37.9(6)	<.02	0.14(40)	0.68(14)	0.42(10)	
6654		stomach contents	0.553	1.10(35)	45(44)	127(10)	16.1(4)	0.25(28)	<.04				144Ce 152(8)
6655		viscera	0.305	1.81(3)	6(40)	7.8(12)	0.25(28)	0.25(28)					60Co 5(60)
6656		skin	0.465	2.88(7)	<9								
6657		liver	0.190	2.28(9)	<9								
Name: Parrotfish													
6682	D-1	muscle	0.207	3.58(5)	24.1(4)	<0.8	0.054(40)	0.71(24)	0.71(24)	0.48(80)	0.36(38)		
6683		bone	0.585	4.88(40)	<100	25(11)	3.32(11)	26.7(4)	0.19(24)	0.58(10)			
6684		stomach contents	0.527	1.94(6)	20(25)	54(6)	26.7(4)	26.7(4)					60Co 13(75)
6685		viscera	0.419	1.94(6)	20(25)	54(6)	26.7(4)	26.7(4)					60Co 209(46)

TABLE 7. (Continued) Concentrations of Radionuclides in Fish Tissue - Bikar Atoll
 $\frac{\text{nCi/kg wet weight}}{\text{wet weight}}$

Sample Island ID	locator	Tissue	Dry/wet Weight	^{40}K $\times 10^{-3}$	^{137}Cs	^{90}Sr	$^{239+240}\text{Pu}$	^{238}Pu $\frac{238\text{Pu}}{239+240\text{Pu}}$	^{241}Am $\frac{241\text{Am}}{239+240\text{Pu}}$	Others
Name: Parrotfish (continued)										
6686		skin	0.441	2.47(9)	<12	11(29)	2.94(19)	.34(40)	<.1	60Co 65(50)
6687		liver	0.340	6.32(5)	<15					
6688	D-4	muscle	0.202	4.01(5)	21.5(3)	1.9(47)	<.008	<.1	<.1	
6689		bone	0.541		<18	20(±2)	1.35(34)	.27(70)	<.1	
6690		stomach contents	0.407	3.39(30)						
6691		viscera	0.345	2.17(5)	18(25)	7 (6)	18.5(4)	.009(50)	.63(8)	60Co 10(33)
6692		skin	0.446	3.08(5)	<9	9 36)	0.47(37)	<.01	<.1	60Co 79(40)
6693		liver	0.257	2.52(40)	<17					
Name: Ulua										
6658	lagoon	muscle	0.219		24.8(3)	<0.1	.009(70)	<.3	<.5	
6659		bone	0.629	0.79(9)	<4	8.7(13)	<.02	<.1	<.1	
6660		stomach contents	lost							
6661		viscera	0.246	2.31(2)	12.3(17)	<3	<.03	<.1	<.1	60Co 5(60)
6662		skin	0.429	3.22(6)	<8	5.0(60)	<.07	<.1	<.1	
6663		liver	0.239	3.07(9)	<15					
6694	lagoon	muscle	0.240	4.25(1)	25.6(3)	0.6(56)	.012(50)	<.1	<.1	
6695		bone	0.663	1.2(13)	<7	12.4(15)	<.01	<.1	<.1	
6696		stomach contents	0.184	3.11(39)	<55					
6697		viscera	0.307	3.02(7)	<8					
6698		skin	0.407	3.11(5)	19(35)	6.2(32)	<.05	<.1	<.1	60Co 41(50)
6699		liver	0.299	3.49(6)	<9					

TABLE 8. Fish Collections Jemo

Island Locator	Common Name	Scientific Name	Number of Individuals Pooled/ Sample	Average Whole Body Wet Weight (gm)	Average Standard Length (mm)	Male	Female
S-1	Surgeonfish	<u>Acanthurus triostegus</u>	2	266±11	160±14	2	0
S-1	Surgeonfish	<u>Acanthurus triostegus</u>	69	97.9±29	125±13	33	36
S-1	Unicornfish	<u>Naso literatus</u>	12	264±64	193±18	7	5
S-1	Threadfin	<u>Polydactylus sexfilis</u>	28	433±49	268±11	13	15

TABLE 9. Concentrations of Radionuclides in Fish Tissue - Jemo
pCi/kg wet weight

Sample Island ID	Tissue	Dry/wet Weight x10 ⁻³	⁴⁰ K	¹³⁷ Cs	⁹⁰ Sr	²³⁹⁺²⁴⁰ Pu	²³⁸ Pu / ²³⁹⁺²⁴⁰ Pu	²⁴¹ Am / ²³⁹⁺²⁴⁰ Pu	Others
Name: Surgeonfish									
6977	S-1 muscle	0.228	3.56(2)	13.9(7)	<2	.13(42)	<.2	.16(16)	
6978	bone	0.622			11(50)	35(5)	.069(18)		
6979	stomach contents	0.355		<37	<60	95(8)	.094(30)		
6980	viscera	0.299	2.34(5)	<6	11(30)	0.4(50)	<.1		
6981	skin	0.392	2.83(11)	50(40)	<12	15(8)	.095(25)	.094(42)	
6982	liver	0.180		<100					
6971	S-1 muscle	0.231	3.61(1)	21.1(5)		.040(20)	<.1	<.3	..
6972	bone	0.631	.58(9)	<3		7.6(3)	.068(10)		
6973	stomach contents	0.128				2.85(3)	.056(11)		¹⁴⁴ Ce 850(20)
6974	viscera	0.145				3.74(1)	.051(4)	0.10(13)	⁶⁰ Co 33(33) ¹⁴⁴ Ce 1030(9)
6975	skin	0.407		38(7)		4.51(2)	.066(9)		⁶⁰ Co 5(35)
6976	liver	0.204	2.86(7)	<10		29.2(3)	.052(12)	<.1	^{113m} Cd 84(11)
Name: Unicornfish									
6965	S-1 muscle	0.219	3.05(2)	8.3(15)			<.2	<.04	
6966	bone	0.589	0.96(21)	<9	17(14)	.27(28)			
6967	stomach contents	0.133	3.27(4)	<4	<4	.15(16)	.18(16)	.28(50)	¹⁴⁴ Ce 237(16)
6968	viscera	0.141	2.60(5)	8.9(24)	2.9(43)	.88(11)		.32(45)	¹⁴⁴ Ce 146(13)
6969	skin	0.565		19(33)	10.4(5)		.16(60)		
6970	liver	0.157	2.08(15)	<14		.46(17)			
Name: Threadfin									
6957	S-1 muscle	0.226	3.48(1)	13.1(3)	<0.1	.002(61)	<.1	<.1	
6958	bone	0.565	.87(9)	<4	7.63(4)	.09(28)		.7(40)	
6959	stomach contents	0.203	2.72(7)	<8	9.3(39)	1.1(25)	.33(60)	.6(70)	
6960	viscera	0.234	3.40(2)	15(12)	<.1	.11(38)	<.1	<.1	
6961	skin	0.481	2.11(8)	<6	2.95(8)	<.004	<.1	<.1	
6962	liver	0.256							

Island Locator	Common Name	Scientific Name	Number of Individuals Pooled/ Sample	Average Whole Body Wet Weight (gm)	Average Standard Length (mm)	Male	Female
L-50	Surgeonfish	<u>Acanthurus triostegus</u>	36	56±13	105±13	32	4
L-55	Surgeonfish	<u>Acanthurus triostegus</u>	4	48±10	96±7	1	3
L-55	Surgeonfish	<u>Acanthurus triostegus</u>	10	82±48	113±24	6	4
L-58	Surgeonfish	<u>Acanthurus triostegus</u>	48	100±48	125±14	21	25
L-37	Mullet	<u>Crenimugil crenilabis</u>	8	590±80	301±14	8	0
L-50	Mullet	<u>Crenimugil crenilabis</u>	11	463±115	274±23	11	0
L-55	Mullet	<u>Crenimugil crenilabis</u>	7	406±326	243±71	5	0 (2 undeveloped)
L-37	Goatfish	<u>Mulloidichthys samoensis</u>	28	71±31	147±18	22	6
L-50	Goatfish	<u>Mulloidichthys samoensis</u>	25	148±38	189±30	26	15
L-58	Goatfish	<u>Mulloidichthys samoensis</u>	56	145±30	190±18	22	34
L-3	Rabbitfish	<u>Siganus rostratus</u>	13	388±66	251±14	11	2
L-55	Rudderfish	<u>Kyphosus cinerascens</u>	25	264±30	187±9	24	1
L-55	Parrotfish	<u>Scarus sordidus</u>	1	723	275	0	1
L-58	Parrotfish	<u>Scarus sordidus</u>	22	565±155	256±15	19	3

TABLE 11. Concentrations of Radionuclides in Fish Tissue - Likiep Atoll
pCi/kg wet weight

Sample Island ID locator	Tissue	Dry/wet Weight x10 ⁻³	⁴⁰ K	¹³⁷ Cs	⁹⁰ Sr	²³⁹⁺²⁴⁰ Pu	²³⁸ Pu <u>239+240</u> Pu	²⁴¹ Am <u>239+240</u> Pu	Others
Name: Surgeonfish									
6387	L-50 muscle	0.243	2.73(2)	7.9(4)	0.9(44)	0.03(60)	<.1	<.1	
6388	bone	0.543	0.51(19)	<5	12.1(12)	0.94(45)	<.3	<.1	
6389	stomach contents	0.101							
6390	viscera	0.142	3.38(3)	<4	<2	2.50(13)	<.03	0.10(50)	
6391	skin	0.434	2.21(6)	16.5(31)	<8	0.50(19)	<.2	<.15	
6392	liver	0.219		<170					
6376	L-55 muscle	0.242	3.30(2)	8(50)			<.5		
6377	bone	0.543		<18	33(65)	1.9(22)			
6378	stomach contents	lost							
6379	viscera	0.142	2.88(12)	<16	<8	2.6(23)	<.2	.19(65)	
6380	skin	0.434	2.77(18)	<25					
6381	L-55 muscle	0.244	3.74(5)	12.1(6)	1.8(48)	.07(60)	<.6	<.5	
6382	bone	0.544		<11	13.6(12)	4.3(13)	.10(50)	<.1	
6383	stomach contents	0.191	5.01(30)	<70					
6384	viscera	0.142	2.72(7)	13(41)	<3	6.2(8)	.03(60)	.08(40)	
6385	skin	0.364	2.67(8)	25(31)	5(75)	2.4(13)	.12(50)	.08(80)	
6386	liver	0.233		<90					
6370	L-58 muscle	0.243	3.99(1)	20(10)	<3	.09(41)	<.4	<.01	
6371	bone	0.543	.39(16)	<3	17.4(8)	8.5(6)	.072(17)	.016(35)	
6372	stomach contents	0.120			<9	6.0(29)	<.1	.13(70)	
6373	viscera	0.185	2.45(2)	12.7(12)	1.8(48)	7.6(7)	.034(30)	.053(12)	144Ce 112(7)
6374	skin	0.435	3.21(2)	21.1(13)	2.0(45)	3.8(6)	.060(25)	.15(50)	
6375	liver	0.233	2.84(7)	<13					
Name: Mullet Crenimugil									
6352	L-37 muscle	0.249	4.14(1)	6.03(2)	0.3(70)	.027(2)	<.1	0.5(50)	
6353	bone	0.581	0.46(18)	<5	13.1(8)	1.4(12)	.07(60)	.07(60)	
6354	stomach contents	0.676	1.42(19)	<20	40(30)	7.1(17)	<.1	.97(25)	
6355	viscera	0.415	2.11(3)	6.1(8)	7.6(13)	3.97(8)	.04(50)	.38(12)	144Ce 63(16)
6356	skin	0.525	2.82(3)	<3	5.9(14)	0.64(16)	.18(50)	<.1	
6357	liver	0.296	3.58(9)	<17					
6364	L-50 muscle	0.229	3.77(1)	7.6(3)	<1	.04(30)	<.1	<.1	
6365	bone	0.484	0.55(16)	<5	0.85(13)	4.8(6)	.060(20)	.060(29)	
6366	stomach contents	lost							
6367	viscera	0.416	3.57(2)	.08(30)	<20	2.7(5)	.054(20)	.65(25)	
6368	skin	0.447	2.82(8)	<4	3.3(5)	1.0(14)	<.03	<.04	
6369	liver	0.232	2.89(13)	<16					
6358	L-55 muscle	0.238	2.68(3)	7.4(19)		.036(19)	<.1	<.1	
6359	bone	0.583		<6		1.86(12)	.08(50)		

TABLE 11. (Continued) Concentrations of Radionuclides in Fish Tissue - Likiep Atoll
pCi/kg wet weight

Sample Island	Dry/wet Weight x10 ⁻³	40K	137Cs	90Sr	239+240Pu	238Pu 239+240Pu	241Am 239+240Pu	Others
Name: Mullet Crenimugil (continued)								
6360	stomach contents	0.672	<40		8.9(7)	.03(50)	0.8(70)	
6361	viscera	0.416	<7		3.5(2)	.037(15)	0.46(13)	144Ce 47(28)
6362	skin	0.476	<4		0.34(18)	<.1		
6363	liver	0.364	<20		15.6(4)	.04(20)	0.082(10)	
Name: Goatfish								
6399	L-37 muscle	0.230	4.9(5)	0.7(54)				
6400	bone	0.364	<7	14(12)	<.1	<.1	<.1	
6401	stomach contents	lost						
6402	viscera	0.269	<14	3.8(69)	<.2	<.1	<.1	
6403	skin	0.440	<6	4.7(13)	.05(50)	<.1	<.1	
6404	liver	lost						
6393	L-50 muscle	0.225	5.63(3)	0.3(45)	.022(36)	<.1	<.1	
6394	bone	0.447	<3	19.8(7)	.06(60)	<.1	<.1	
6395	stomach contents	lost						
6396	viscera	0.334	6.6(40)	4.9(34)	1.1(16)	<.1	.34(35)	
6397	skin	0.399	<3	3.7(17)	.12(25)	.3(60)	<.2	
6398	liver	0.259	<20					
6405	L-58 muscle	0.230	7.18(3)	<0.2	<.003	<.1	<.1	
6406	bone	0.486	<2	14(9)	<.04	<.1	<.5	
6407	stomach contents	0.250	<25					
6408	viscera	0.255	<3	<.1	0.16(30)	<.1	<.2	
6409	skin	0.468	<3	4.6(16)	.02(90)	<.1	<.5	
6410	liver	0.249	<11					
Name: Rabbitfish								
6422	L-3 muscle	0.226	4.11(2)	<0.1	<.02	<.1	<.1	
6423	bone	0.528	0.65(19)	15(4)	0.25(30)	<.3	<.1	
6424	stomach contents	0.115	2.67(22)	<40				
6425	viscera	0.142	1.75(3)	4(40)	0.37(17)	<.06	.04(40)	
6426	skin	0.299	4.11(3)	<2	1.3(31)	<.02	<.3	
6427	liver	0.219	3.61(18)	<20	0.081(18)	<.02		
Name: Rudderfish								
6428	L-55 muscle	0.209	3.47(1)	<0.3	.042(24)	<.1	<.2	
6429	bone	0.481	0.61(11)	12.0(9)	0.91(12)	<.1	.08(80)	
6430	stomach contents	0.073	1.92(3)	<0.4	0.93(12)	.07(70)	.39(25)	
6431	viscera	0.140	1.95(5)	2.6(41)	1.80(10)	.072(45)	.44(25)	
6432	skin	0.453	2.83(4)	4.0(24)	0.35(16)	<.1	.13(80)	
6433	liver	0.233	2.91(17)	<20				

TABLE 11. (Continued) Concentrations of Radionuclides in Fish Tissue - Likiep Atoll
 nCi/kg wet weight

Sample Island ID	Tissue	Dry/wet weight	^{40}K $\times 10^{-3}$	^{137}Cs	^{90}Sr	$^{239+240}\text{Pu}$	$\frac{^{238}\text{Pu}}{^{239+240}\text{Pu}}$	$\frac{^{241}\text{Am}}{^{239+240}\text{Pu}}$	Others
Name: Parrotfish									
6417	L-55 muscle	0.219	3.85(2)	10.0(6)	<1	.74(30)	<.1	<.2	
6418	bone	0.538	0.84(20)	<9	8(50)	1.4(21)	<.1	<.1	
6419	viscera	0.404	2.07(9)	<9	6(40)	5.4(8)	.06(45)	.94(25)	
6420	skin	0.398	3.80(6)	<14	<5	0.84(19)	<.1	<.06	
6421	liver	0.322	3.85(23)	<31					
6411	L-58 muscle	0.196	3.62(1)	14.4(3)	<.04	.010(30)	<.4	<.1	
6412	bone	0.505	0.69(9)	<3	15(17)	.42(14)	.06(75)	.26(45)	
6413	stomach contents	0.599	1.82(16)	<13	12(50)	7.4(14)	.09(60)	.39(22)	
6414	viscera	0.484	1.71(4)	<4					
6415	skin	0.407	2.53(2)	12(14)	2.6(18)	0.12(28)	<.2	.12(80)	
6416	liver	0.438	1.82(5)	<4	<1	4.0(8)	.060(36)	.074(29)	

TABLE 12. Fish Collections Mejit Atoll

Island Locator	Common Name	Scientific Name	Number of Individuals Pooled/ Sample	Average Whole Body Wet Weight (gm)	Average Standard Length (mm)	Male	Female
R-1	Flagtails	Khufia <u>taeniuma</u>	70	96.5±17	166±10	20	50

TABLE 13. Concentrations of Radionuclides in Fish Tissues - Mejit
pCi/kg wet weight

Sample Island	Dry/wet	40K	137Cs	90Sr	239+240Pu	238Pu	241Am	Others
ID	locator	Tissue	Weight x 10 ⁻³					
Name: Flagtails								
6983	R-1	muscle	0.231	3.41(2)	6.8(10)	<.002	<.002	<4
6984		bone	0.596	0.24(20)	<2	.04(50)	<.04(50)	<1
6985		stomach contents	0.151	1.22(24)	<6	.18(26)	<.18(26)	<1
6986		viscera	0.238	2.64(2)	6(30)	.33(9)	<.33(9)	<1
6987		skin	0.637	3.15(4)	<3	.032(90)	<.032(90)	<1
6988		liver	0.235	2.63(4)	<4	.047(60)	<.047(60)	<1

TABLE 14. Fish Collections - Rongelap Atoll

Island Locator	Common Name	Scientific Name	Number of Individuals Pooled/ Sample	Average Whole Body Wet Weight (gm)	Average Standard Length (mm)	Male	Female
F-1	Surgeonfish	<u>Acanthurus triostegus</u>	51	30±8	86±8	50	1
F-5	Surgeonfish	<u>Acanthurus triostegus</u>	42	33±10	85±9	36	6
F-23	Surgeonfish	<u>Acanthurus triostegus</u>	44	29±8	83±8	38	6
F-33	Surgeonfish	<u>Acanthurus triostegus</u>	45	95±16	129±8	22	23
F-42	Surgeonfish	<u>Acanthurus triostegus</u>	45	73±33	109±18	33	12
F-46	Surgeonfish	<u>Acanthurus triostegus</u>	27	73±22	113±12	9	18
F-47	Surgeonfish	<u>Acanthurus triostegus</u>	22	49±14	97±12	15	7
F-1	Mullet	<u>Crenimugil crenilabis</u>	18	90±30	164±19	16	2
F-5	Mullet	<u>Crenimugil crenilabis</u>	4	724±80	322±12	2	2
F-9	Mullet	<u>Crenimugil crenilabis</u>	13	750±68	322±12	0	13
F-23	Mullet	<u>Crenimugil crenilabis</u>	12	473±65	261±13	9	3
F-47	Mullet	<u>Crenimugil crenilabis</u>	12	664±187	298±29	4	8
F-13	Mullet	<u>Neomyxus chaptalii</u>	15	445±84	263±15	0	15
F-1	Goatfish	<u>Mulloidichthys samoensis</u>	13	104±26	166±15	13	0
F-9	Goatfish	<u>Mulloidichthys samoensis</u>	43	119±36	180±17	30	13
F-13	Goatfish	<u>Mulloidichthys samoensis</u>	59	61±14	141±11	51	8
F-33	Goatfish	<u>Mulloidichthys samoensis</u>	65	78±24	156±15	43	22
F-42	Goatfish	<u>Mulloidichthys samoensis</u>	53	79±22	154±12	46	7
F-5	Parrotfish	<u>Scarus sordidus</u>	15	546±141	238±21	0	15
Lagoon	Mackerel	<u>Grammotorcynus bilineatus</u>	2	1406±440	518±53	1	1
Lagoon	Rainbow Runner	<u>Elagatis sp.</u>	2	1983±666	538±62	1	1
Lagoon	Bonito	<u>Euthynnus affinis</u>	1	3002	525	1	0
Lagoon	Bonito	<u>Euthynnus affinis</u>	1	3884	575	1	0
Lagoon	Snapper	<u>Aprion virescens</u>	1	4917	670	0	1

TABLE 15. Concentrations of Radionuclides in Fish Tissue - Rongelap Atoll
pCi/kg wet weight

Sample Island ID	locator	Tissue	Dry/wet Weight	40K x10 ⁻³	137Cs	90Sr	239+240Pu	238Pu / (239+240Pu)	241Am / (239+240Pu)	Others
Name: Surgeonfish										
7029	F-1	muscle	0.212	3.50(1)	61(10)	1.2(14)	.59(11)	<.01	<.03	60Co 10(12)
7030		bone	0.571	<6	<6	380(3)	117(4)	.004(42)	.16(10)	
7031		stomach contents	0.134	2.03(20)	111(23)					
7032		viscera	0.136	2.51(8)	52(15)	46(4)	10.3(4)	.034(35)	.49(7)	60Co 28(25)
7033		skin	0.390	2.23(12)	51(29)	58(6)	88.7(3)	.002(70)	.024(17)	
7034		liver	0.253	<24	<24					
7056	F-5	muscle	0.213	3.51(2)	47(9)	0.7(30)	0.47(12)	.09(60)	<.02	60Co 3.9(40)
7057		bone	0.606	<6	<6	210(2)	68(4)	.005(35)	.062(15)	
7058		stomach contents	0.114	1.65(21)	<22					
7059		viscera	0.150	2.44(3)	34(9)	55(4)	87(5)	.002(60)	.29(7)	60Co 25.7(12) 144Ce 74(26)
7060		skin	0.392	2.98(5)	38(21)	33(8)	47(5)	.006(70)	.028(20)	60Co 14(65)
7061		liver	0.247	2.63(22)	<28					60Co 80(34)
7062	F-23	muscle	0.205	3.18(2)	36(9)	<1.0	0.29(14)	<.02	.14(75)	
7063		bone	0.571	<7	<7	123(2)	39.1(5)	.010(50)	.31(25)	
7064		stomach contents	0.116	2.43(21)	<27					
7065		viscera	0.137	2.41(4)	32(15)	35.3(4)	66.5(4)	.003(40)	.25(6)	60Co 15(28) 144Ce 77(36)
7066		skin	0.373	3.13(4)	37(17)	24.0(5)	23.8(6)	.04(25)	.064(20)	60Co 12(53)
7067		liver	0.250	2.99(31)	<45					
7023	F-33	muscle	0.212	3.52(2)	34(9)	<0.2	.21 0)	<.01	.47(50)	60Co 4.2(15)
7024		bone	0.636	<3	<3	78(2)	25(3)	.014(13)		
7025		stomach contents	0.109	2.39(9)	23(42)	<8	<0.2	<1		
7026		viscera	0.145	2.51(1)	24(5)	9.0(8)	30.8	.005(40)	.20(5)	60Co 21(39)
7027		skin	0.386	3.00(2)	25(12)	11.3(9)	21.4	.014(32)	.078(20)	60Co 25(6) 144Ce 39(22)
7028		liver	0.250	2.97(11)	<14					60Co 13(20) 207Bi 7(70)
7035	F-42	muscle	0.216	2.81(2)	17. 8)	<0.5	.064(23)	<0.2		
7036		bone	0.576	.29(20)	<4	29(4)	10.8(6)	.04(25)	.043(20)	60Co 22(63)
7037		stomach contents	0.125	2.30(8)	<8	<1	12.1(10)	<1	.32(20)	60Co 11(26) 144Ce 54(23)
7038		viscera	0.151	2.50(2)	13(15)	4.8(17)	8.86(3)	.009(34)	.33(8)	
7039		skin	0.379	3.08(4)	15(24)	2.5(48)	8.12(6)	.043(27)	.071(20)	
7040		liver	0.256	3.98(5)	<10					60Co 48(36)
7017	F-46	muscle	0.211	3.23(4)	23(11)	<0.7	0.24(12)	.08(70)	.054(45)	
7018		bone	0.589	0.56(17)	<4	43(5)	29.3(5)	.017(40)	.048(17)	
7019		stomach contents	0.084	1.78(23)	<17					
7020		viscera	0.140	2.21(6)	17(25)	5*4(15)	30*9(3)	.007(28)	.092(10)	60Co 25(18)
7021		skin	0.365	2.57(7)	<14	0.6(30)	1.92(6)	.014(60)	.047(25)	
7022		liver	0.239	2.76(16)	<21					

TABLE 15. (continued) Concentrations of Radionuclides in Fish Tissue - Rongelap Atoll
pCi/kg wet weight

Sample Island	ID	locator	Tissue	Dry/wet Weight x10 ⁻³	40K	137Cs	90Sr	239+240Pu	238Pu 239+240Pu	241Am 239+240Pu	Others
	7068	F-47	muscle	0.211	3.27(2)	23.5(3)	<0.7				
	7069		bone	0.605	0.30(34)	<5	131(4)	28(5)	.24(50)	.25(75)	60Co 9(44)
	7070		stomach contents	0.182	<33	<33			.007(80)	.084(14)	
	7071		viscera	0.160	2.04(4)	23(19)	44(4)	32(4)	.004(42)	.37(6)	60Co 24(17)
	7072		skin	0.389	3.31(7)	27(38)	21.5(13)	11.4(10)	.05(55)	.066(30)	
	7073		liver	0.251		<38					
NAME: Mullet Crenimugil											
	7098	F-1	muscle	0.218	2.81(2)	27(10)	0.9(25)	1.37(7)	.03(55)	.015(25)	60Co 5(27)
	7099		bone	0.535		<7	149(4)	34.8(7)	.009(75)	.040(20)	
	7100		stomach contents	Lost							
	7101		viscera	0.237	2.46(3)	31(13)	4.3(32)	38.5(4)	.006(47)	.071(5)	60Co 29(14)
	7102		skin	0.520	2.88(4)	20(23)	71.8(2)	9.97(6)	<.003	.075(20)	60Co 67(28)
	7103		liver	0.223	3.82(12)	<25					
	7086	F-5	muscle	0.232	3.75(2)	27(7)	0.87(14)	1.28(6)	.01(65)	.092(15)	60Co 11(11)
	7087		bone	0.651	0.78(17)	<7	466(2)	53.3(3)	.004(35)	.147(8)	60Co 31(31)
	7088		stomach contents	Lost							
	7089		viscera	0.309	2.09(4)	41(8)	709(2)	2.48(8)	.017(75)		60Co 43(6) 155Eu 138(4)
	7090		skin	0.567	2.18(6)	<7	267(3)	20.4(5)	<.003	.137(8)	144Ce 249(14)
	7091		liver	0.236	3.37(8)	<14					
	6992	F-9	muscle	0.234	3.63(1)	16.2(4)			<.05	0.038(7)	60Co 9.5(9)
	6993		bone	0.648	0.68(15)	<6			.079(16)		
	6994		stomach contents	0.058	<26	<26			.11(50)	<0.03	
	6995		viscera	0.223	3.19(2)	13.2(10)			.053(5)	0.074(9)	60Co 62(4)
	6996		skin	0.535	2.14(5)	<5			.07(25)		60Co 24(19)
	6997		liver	0.117	3.83(3)	12(26)					60Co 206(3)
	7080	F-23	muscle	0.231		21(5)	0.53(14)	0.54(7)	<.007	.074(20)	60Co 14(8)
	7081		bone	0.601	0.50(27)	<6	212(2)	43(4)	.005(27)	.007(20)	60Co 32(20)
	7082		stomach contents	0.596	.70(30)	<13	1234(3)	427(4)	.001(80)	.81(5)	60Co 25(60) 155Eu 311(7)
	7083		viscera	0.417	1.63(3)	32(7)	623(2)	217(3)	.008(20)	.73(7)	60Co 36(6) 155Eu 115(4)
	7084		skin	0.533	2.49(4)	12(23)	114(3)	16.1(6)	.004(80)	.077(10)	144Ce 252(8)
	7085		liver	0.232	2.83(13)	<16					60Co 36(11) 155Eu 27(38)

TABLE 15. (continued) Concentrations of Radionuclides in Fish Tissue - Rongelap Atoll
pCi/kg wet weight

Sample Island ID	locator	Tissue	Dry/wet Weight	40k x10 ⁻³	137Cs	90Sr	239+240Pu	238Pu / 239+240Pu	241Am / 239+240Pu	Others
NAME: Mullet <u>Crenimugil</u> (continued) ^A										
7074	F-47	muscle	0.223	3.81(1)	36(6)	0.18(34)	0.34(9)	.03(70)	.079(20)	60Co 12(12)
7075		bone	0.625	0.56(24)	<5	<2	16(5)	.007(40)	.017(60)	60Co 21(30)
7076		stomach contents	0.627	.57(23)	427(3)	1608(3)	364(5)	.002(50)	.65(7)	60Co 21(35) 155Eu 149(9)
7077		viscera	0.390	1.52(3)	88(3)	432(3)	153(3)	.0013(20)	.63(4)	144Ce 322(29) 60Co 23(9) 155Eu 43(8)
7078		skin	0.550	2.23(6)	<5	34(8)	5.8(6)	<.002	<.02	144Ce 106(24) 60Co 23(20) 155Eu 37(37)
7079		liver	0.234		<10		176(2)	.0036(15)	.077(10)	108mAg 3.3(71)
NAME: Mullet <u>Neomyxus</u>										
7128	F-13	muscle	0.212	3.32(1)	133(2)	2.1(8)	.075(13)	.08(70)		60Co 10(9)
7129		bone	0.621	0.47(12)	<4	846(3)	17.7(7)	.011(40)	.15(13)	
7130		stomach contents	0.113	1.29(25)	60(29)					
7131		viscera	0.238			2.5(16)	25.4(4)	.0027(33)	.096(7)	
7132		skin	0.517	2.43(3)	83(5)	478(3)	6.7(5)	<.001	.125(10)	60Co 29(13)
7133		liver	0.223	3.80(4)	128(7)		348(4)	.0024(25)		60Co 711(2) 113mCd 6690(2)
Name: Goatfish										
7104	F-1	muscle	0.221	3.64(9.5(10)	2.75(9)	.040(40)	<.2	<0.1	60Co 36(7)
7105		bone	0.527		<10	52(3)	.18(12)	<.005	0.3(80)	60Co 53(22)
7106		stomach contents								
7107		viscera	0.381	3.66(7)	<15	823(3)	227(5)	.002(80)	.71(6)	60Co 432(7) 155Eu 120(17)
7108		skin	0.573	4.15(4)	<7	306(2)	0.87(24)	<.1	<.07	60Co 130(10)
7109		liver	0.365	5.1(28)	<58					60Co 1193(7)
7170	F-9	muscle	0.220	3.62(1)	7.7(3)	0.62(12)	.013(57)	<.5	<.2	
7171		bone	0.531	0.24(32)	37(14)	153(2)	.74(12)	.06(80)	.17(60)	125Sb 64(33)
7172		stomach contents	0.213		<25					
7173		viscera	0.372	3.23(4)	10(29)	126(3)	66(4)	.002(75)	.64(7)	60Co 109(5) 155Eu 38(21)
7174		skin	0.525	3.63(3)	<4	84(3)	.41(15)	.14(70)		60Co 29(14)
7175		liver	0.255	4.05(8)	<17					60Co 297(8)
7122	F-13	muscle	0.208	3.62(1)	8.7(2)	1.1(16)	.079(21)	<.1	<.1	
7123		bone	0.519	0.38(20)	<4	351(2)	1.01(13)	<.1	.19(60)	
7124		stomach contents								
7125		viscera	0.234	3.42(10)	<10	50(3)	22.9(4)	.011(37)	.45(8)	60Co 140(10)
7126		skin	0.515	3.68(3)	<4	179(3)	.91(23)	<.2	.50(40)	60Co 30(18)
7127		liver	0.225	4.61(9)	<20					60Co 262(9)

TABLE 15. (continued) Concentrations of Radionuclides in Fish Tissue - Rongelap Atoll
pCi/kg wet weight

Sample ID	Island locator	Tissue	Dry/wet Weight x 10 ⁻³	⁴⁰ K	¹³⁷ Cs	⁹⁰ Sr	²³⁹⁺²⁴⁰ Pu	²³⁸ Pu	²⁴¹ Am	Others
							$\frac{239+240}{239+240}$ Pu	$\frac{238}{239+240}$ Pu	$\frac{241}{239+240}$ Am	
Name: Goatfish (continued)										
7161	F-33	muscle	0.214	3.57(1)	7.4(2)	0.30(16)	.034(30)	<.3	0.5(40)	
7162		bone	0.536	.33(28)	44(15)	75.5(4)	.34(31)	<.3	0.6(50)	125Sb 72(25)
7163		stomach contents	0.179	<50						
7164		viscera	0.242	3.49(2)	<3	3.5(16)	3.33(9)	<.02	0.5(30)	60Co 74(5)
7165		skin	0.525	3.44(3)	<3	39.5(6)	.15(50)	<.4	<.6	
7166		liver	0.247	4.15(8)	<17					
7092	F-42	muscle	0.221	3.76(1)	5.8(13)	0.46(21)	.008(75)	<.1	<.7	60Co 5.0(17)
7093		bone	0.512	0.43(16)	<3	123(3)	.46(3)	.13(30)	.18(50)	60Co 10(37)
7094		stomach contents	0.294	<19						
7095		viscera	0.415	3.54(4)	<6	23(5)	23(6)	.020(50)	.56(7)	60Co 65(14)
7096		skin	0.504	4.03(2)	<3	63(4)	.19(23)	<.04	.3(60)	60Co 16(21)
7097		liver	0.269							
Name: Parrotfish										
7011	F-5	muscle	0.206	4.06(1)	18.0(10)	<0.1	.15(9)	.07(40)	<.05	60Co 2(60)
7012		bone	0.551	.58(8)	<3	24(6)	16(5)	.006(40)	.055(17)	
7013		stomach contents	0.449	<28		154(5)	92(7)	<.004		
7014		viscera	0.428	1.61(3)	15(15)	101(3)	81(4)	.0023(21)	.75(10)	60Co 10(20) 155Eu 53(8)
7015		skin	0.447	2.49(3)	<3	8.3(4)	9.4(4)	.008(42)	.054(14)	144Ce 374(8)
7016		liver	0.417	2.13(4)	<4	100(4)	100(4)	.0057(10)		60Co 33(14) 113mCd 2500(2)
Name: Mackerel										
7110	lagoon	muscle	0.243	4.67(2)	27.9(3)	<0.2	.009(43)	<.1	<.1	
7111		bone	0.589	.62(17)	<5	4.2(14)	.03(50)	<.1	<.5	
7112		stomach contents	0.239	<17						
7113		viscera	0.233	3.18(3)	19(25)	<2	.13(43)	<.5	<.5	
7114		skin	0.339	3.84(4)	19(24)	<3	<.07	<.1	<.5	
7115		liver	0.283	4.50(10)	<21					
Name: Rainbow Runner										
7116	lagoon	muscle	0.255	4.13(1)	14.2(6)	<0.2	<.004	<.1	<.25	
7117		bone	0.597	<7	12(15)	12(15)	.10(80)	<.1	<.3	
7118		stomach contents	0.207	2.48(5)	<5	<3	1.1(21)	<.04	0.8(40)	
7119		viscera	0.332	3.26(2)	10(32)	<2	0.09(50)	<.5	<.5	
7120		skin	0.477	<5	<5	<5	<.07	<.1	<.1	
7121		liver	0.280	2.79(8)	<7					

TABLE 15. (continued) Concentrations of Radionuclides in Fish Tissue - Rongelap Ato
pCi/kg wet weight

Sample Island ID	locator	Tissue	Dry/wet Weight x10 ⁻³	40K	137Cs	90Sr	239+240Pu	238Pu 239+240Pu	241Am 239+240Pu	Others
Name: Bonito										
7143	lagoon	muscle	0.298	3.59(1)	18.5(6)	<0.6				60Co 3.2(27)
7144		bone	0.624		<8	7.6(11)				
7145		stomach contents								
7146		viscera	0.225	3.06(3)	17(23)	<2				60Co 13(27)
7147		skin	0.570	2.19(6)	<6	<4				
7148		liver	0.302	4.43(6)	<13					
7149	lagoon	muscle	= .294	3.45(1)	18.8(2)	<0.2	<.005	<1	<1	60Co 2.8(33)
7150		bone	= .659		<10	8.7(14)	.17(60)	<1	<.2	
7151		stomach contents	= .242	2.42(8)	<12	<5	0.6(60)	<.5	<.2	
7152		viscera	= .212	3.31(1)	18.9(7)	<1	.13(45)	<.1	<.2	60Co 8.5(17)
7153		skin	= .558	1.58(8)	<6	<3	<.03	<1	<1	
7154		liver	= .354	3.85(6)	<11					
Name: Snapper										
7155	lagoon	muscle	0.214	3.73(1)	18.2(3)	<0.2	.007(60)	<1	<1	60Co 2.9(28)
7156		bone	0.558	.80(5)	<2	39(4)	.19(29)	<.5	.6(50)	
7157		stomach contents								
7158		viscera	0.223	2.07(6)	<6	<1	.80(16)	<.05	.6(70)	
7159		skin	0.442	3.66(7)	<35	18(7)	.61(29)	<.1		60Co 441(7)
7160		liver	0.275							

TABLE 16. Fish Collections - Rongerik Atoll

Island Locator	Common Name	Scientific Name	Number of Individuals Pooled/ Sample	Average Whole Body Wet Weight (gm)	Average Standard Length (mm)	Male	Female
G-1	Surgeonfish	<u>Acanthurus triostegus</u>	64	72±26	113±10	61	3
G-6	Surgeonfish	<u>Acanthurus triostegus</u>	45	71±23	115±11	20	25
G-11	Surgeonfish	<u>Acanthurus triostegus</u>	45	73±16	118±12	32	13
G-12	Surgeonfish	<u>Acanthurus triostegus</u>	67	64±22	111±10	63	4
G-1	Mullet	<u>Neomyxus chaptalii</u>	15	159±80	191±34	9	6
G-11	Mullet	<u>Neomyxus chaptalii</u>	20	129±68	179±31	14	6
G-6	Goatfish	<u>Mulloidichthys samoensis</u>	19	232±64	224±18	10	9
G-11	Parrotfish	<u>Scarus sordidus</u>	2	493±134	239±13	2	0
G-1	Threadfin	<u>Polydactylus sexfilis</u>	6	738±137	306±15	1	5
Lagoon	Mackerel	<u>Grammatocynus bilineatus</u>	1	891	455	0	1
Lagoon	Snapper	<u>Aprion virescens</u>	2	1914±499	505±35	1	1
Lagoon	Ulua	<u>Caranx sp.</u>	1	2434	495	0	1
Lagoon	Grouper	<u>Epinephelus sp.</u>	1	2273	525	1	0
Lagoon	Tuna	<u>Gymnosarda nuda</u>	2	5773±198	750±20	0	2

TABLE 17. Concentrations of Radionuclides in Fish Tissue - Rongerik Atoll
pCi/kg wet weight

Sample ID	Island locator	Tissue	Dry/wet Weight x10 ⁻³	¹³⁷ Cs	⁹⁰ Sr	²³⁹⁺²⁴⁰ Pu	²³⁸ Pu	²⁴¹ Am	Others
Name: Surgeonfish									
6790	G-1	muscle	0.233	15.8(7)	<0.2	15(13)	<.02	.10(50)	
6791		bone	0.588	<5	31(5)	18.2(4)	.035(17)	.036(18)	
6792		stomach contents	0.137	7(4)	4.4(40)	8.6(7)	.030(50)	.29(12)	¹⁵⁵ Eu 30(34) ¹⁴⁴ Ce 143(36)
6793		viscera	0.146	6(1)	12.1(5)	13.3(4)	.017(28)	.11(7)	¹⁵⁵ Eu 10(37) ¹⁴⁴ Ce 106(10)
6794		skin	0.378	2(4)	4.2(30)	14.7(5)	.031(24)	.039(15)	
6795		liver	0.201	10					¹⁵⁵ Eu 40(33)
6778	G-6	muscle	0.229	19.9(10)	0.6(35)	3.1(85)	<.1	<.7	
6779		bone	0.617	<3	67(7)	3.1(8)	<.02	.14(30)	
6780		stomach contents	0.329	<34					
6781		viscera	0.221	23(12)	<2	4.1(8)	<.02	.44(16)	
6782		skin	0.384	23(13)	6.7(16)	1.1(1)	.07(70)	.07(40)	60Co 26(40)
6783		liver	0.200	<12					
6784	G-11	muscle	0.223	22(13)	0.4(50)	.072(28)	<.5	.3(50)	
6785		bone	0.641	<4	35(5)	4.3(8)	<.01	.047(20)	
6786		stomach contents	0.269	<49					
6787		viscera	0.180	21(14)	8.1(22)	4.7(7)	<.005	.44(18)	
6788		skin	0.356	20(15)	5.1(20)	2.3(9)	<.02	.07(40)	
6789		liver	0.210	<26					
6814	G-12	muscle	.213	21.2(5)	<0.2	.12(14)	<.02	<.05	60Co 4(28)
6815		bone	.623	<7	38(9)	8.7(4)	.017(30)	.08(20)	
6816		stomach contents	.149	35(24)	12(37)	18.6(9)	.19(20)	.19(20)	
6817		viscera	.140	21(9)	4.9(12)	24.2(4)	.008(30)	.10(10)	60Co 14(14)
6818		skin	.362	7.7(6)	7.7(6)	16.3(4)	.019(25)	.025(30)	60Co 33(80)
6819		liver	.182	<12					
Name: Mullet Neomyxus									
6754	G-1	muscle	0.242	2.49(2)	5.3(31)	0.30(5)	.04(26)		
6755		bone	0.575	0.37(18)	<3				
6756		stomach contents	0.576	1.99(14)	<13	50.6(3)	.007(37)	0.58(8)	¹⁵⁵ Eu 95(36)
6757		viscera	0.447	1.76(4)	<2	22.3(3)	.0095(1)		¹⁵⁵ Eu 32(14)
6758		skin	0.520	0.76(4)	<1	.64(8)	.06(45)		¹⁵⁵ Eu 10(43) ⁶⁰ Co 4(40)
6759		liver	0.220	1.65(14)	<10	22.9(7)	.07(30)	<.3	60Co 52(24)
6760	G-11	muscle	0.235	2.81(1)	7.3(7)	.07(24)	<.04	<.05	
6761		bone	0.591	0.60(25)	<7	2.45(11)	<.02	.18(35)	
6762		stomach contents	0.598	<49	78(9)	23(14)		.44(20)	
6763		viscera	0.427	11(31)	8.7(6)	8.9(5)	.013(40)	.62(12)	
6764		skin	0.529	1.97(4)	1.6(45)	0.59(17)	<.05	<.1	
6765		liver	0.215	<11					

TABLE 17. (Continued) Concentrations of Radionuclides in Fish Tissue - Rongerik Atoll
pCi/kg wet weight

Sample Island	Dry/wet	⁴⁰ K	¹³⁷ Cs	⁹⁰ Sr	²³⁹⁺²⁴⁰ Pu	²³⁸ Pu	²⁴¹ Am	Others
ID locator Tissue	Weight	x 10 ⁻³						
Name: Goatfish								
6820	6-6	muscle	4.68(1)	9.0(12)	0.8(15)	.02(63)	<.6	60Co 6(21)
6821		bone	.62(11)	<3	135(2)	.47(15)	.38(40)	
6822		stomach contents	0.163					
6823		viscera	3.47(3)	11(42)	11(19)	7.1(9)	.61(13)	60Co 68(14)
6824		skin	0.285		52(3)	<.04	<.1	
6825		liver	0.489					
			0.206					
Name: Parrotfish								
6772	6-11	muscle	3.63(3)	14.3(9)	<0.6	<.007	<.1	
6773		bone	1.1(16)	<8	10(27)	1.6(23)	<.03	
6774		stomach contents	lost					
6775		viscera	0.401	<11	25(12)	11.5(7)	.76(24)	
6776		skin	0.424	<12	10(27)	<.3	<.1	
6777		liver	0.503					
Name: Threadfin								
6766	6-1	muscle	0.279 ⁿ	16.3(3)	0.5(30)	<.003	<.1	
6767		bone	0.602	<5	16(10)	<.03	<.1	
6768		stomach contents	0.214	<10		1.1(80)	<.4	
6769		viscera	0.196		<0.9	0.13(40)	<.5	
6770		skin	0.461	7.7(30)	3.6(30)	<.008	<.1	
6771		liver	0.231	<12				
Name: Mackerel								
6796	lagoon	muscle	0.238	15.7(10)	<0.6	<.02	>.1	
6797		bone	0.549	<12	19(31)	<.2	<.1	
6798		stomach contents	0.266	<27	<8			
6799		viscera	0.272	<36				
6800		skin	0.320	<16	<7	<.4	<.2	
6801		liver	0.216	<47				60Co 100(60)
Name: Snapper								
6802	lagoon	muscle	0.230	15.6(4)	<0.3	.009(75)	<.8	
6803		bone	0.647	<5	16.9(4)	.11(40)	1(50)	
6804		stomach contents	0.121	<80			<.2	
6805		viscera	0.219	13(30)	<4	1.0(80)	<.3	
6806		skin	0.406	9(40)	<11	<.04	<.1	
6807		liver	0.226	<17				

TABLE 17. (Continued) Concentrations of Radionuclides in Fish Tissue - Rongerik Atoll
pCi/Kg wet weight

Sample Island ID	locator	Tissue	Dry/wet Weight x10 ⁻³	137 Cs	90 Sr	239+240 Pu	238Pu / 239+240Pu	241Am / 239+240Pu	Others
Name: Ulua									
6808	lagoon	muscle	0.236	30.8(3)	<0.2	.02(67)	<.5	<1	
6809		bone	0.665	<6	20(9)	.09(75)	<.5	<1	
6810		stomach contents	0.221	<29					60Co 70(80)
6811		viscera	0.249		<3	.17(50)	<.5	<.4	
6812		skin	0.378	29(27)	7(65)	<.09	<1	<1	
6813		liver	0.285	<17					60Co 47(80)
Name: Grouper									
6826	lagoon	muscle	0.213	43(9)	<0.3	<.02	<1	<1	
6827		bone	0.648	12(38)	17(23)	.13(7)	<1	<.5	
6828		stomach contents	0.085						
6829		viscera	0.244	19(30)	10(28)				
6830		skin	0.385	15(39)		<.3	<1	<2	
6831		liver	0.255	<16					
Name: Tuna									
6832	lagoon	muscle	0.240	28.0(6)	14(35)	.005(38)	<1	<1	
6833		bone	0.634		12(15)	<.02	<1	<1	
6834		stomach contents	0.249	25(26)	2.7(43)	<.05	<1	<3	
6835		viscera	0.237	27(12)	<2	<.07	<1	<7	
6836		skin	0.396	18(12)	12(50)	<.5	<.5	<1	
6837		liver	0.211	20(27)	1.8(70)	0.20(40)	<.5	<.5	

Island Locator	Common Name	Scientific Name	Number of Individuals Pooled/ Sample	Average Whole Body Wet Weight (gm)	Average Standard Length (mm)	Male	Female
H-4	Surgeonfish	<u>Acanthurus triostegus</u>	33	108±27	132±10	20	13
H-5	Surgeonfish	<u>Acanthurus triostegus</u>	26	39±16	93±12	24	2
H-1	Mullet	<u>Neomyxus chaptalii</u>	34	182±36	207±9	33	1
H-4	Mullet	<u>Neomyxus chaptalii</u>	20	161±38	204±26	11	9
H-5	Mullet	<u>Neomyxus chaptalii</u>	16	153±45	187±56	16	0
H-1	Snapper	<u>Lethrinus kallopterus</u>	2	2618±1040	542±48	0	2
Lagoon	Jack	<u>Caranx sp.</u>	1	5585	670	0	1

TABLE 19. Concentrations of Radionuclides in Fish Tissue - Taka Atoll
pCi/kg wet weight

Sample ID	Island	Locator	Tissue	Dry/wet Weight x 10 ⁻³	40K	137Cs	90Sr	239+240Pu	238Pu	241Am	Others
ID	Locator	Tissue						239+240Pu	239+240Pu	239+240Pu	241Am
Name: Surgeonfish											
6443	H-4	muscle		0.219	3.03(2)	16.5(3)	0.3(67)	.05(23)	<.1	<.2	
6444		bone		0.607	0.91(17)	<7	17(10)	4.3(7)	.05(40)	.02(50)	
6445		stomach contents		0.087	3.30(9)	<10					
6446		viscera		0.130	2.59(6)	14(19)	<.02	6.51(6)	.037(30)	.079(15)	60Co 6(34)
6447		skin		0.314	2.82(3)	16(19)	2.3(38)	2.00(9)	.07(40)	<.02	
6448		liver		0.210	2.72(17)	<22					
6437	H-5	muscle		0.213	3.41(3)	13.2(12)	0.8(70)	.12(30)	<.3	.03(80)	
6438		bone		0.565	<11	<11	21(9)	12.1(8)	<.02	.032(60)	
6439		stomach contents		0.113	2.91(15)	<27	<2	10.8(6)	.059(32)	.039(24)	
6440		viscera		0.117	2.42(7)	14(36)	4(67)	7.6(9)	.043(60)	.032(75)	
6441		skin		0.319	2.39(9)	<7					
6442		liver		0.172	<88						
Name: Mullet Neomyxus											
6449	H-1	muscle		0.227	2.72(2)	3.6(10)	0.3(55)	0.19(9)	.08(50)	.15(32)	
6450		bone		0.612	0.40(17)	<3	40(5)	4.47(9)	.069(35)	.005(70)	
6451		stomach contents		0.559	1.73(11)	<9	37(14)	17.7(5)	.04(25)	1.0(20)	
6452		viscera		0.401	1.72(3)	5(25)	16(8)	8.6(4)	.024(15)	.33(18)	
6453		skin		0.457	2.39(4)	<4	4.0(15)	1.01(8)	.06(40)	<.02	
6454		liver		0.230	2.06(8)	<10	<5	25(4)	.05(20)	.13(25)	
6461	H-4	muscle		0.232	2.69(2)	3.7(12)	0.6(56)	0.13(17)	<.05	<.06	
6462		bone		0.595	0.65(23)	<8	19(14)	2.8(9)	.078(40)	.026(50)	
6463		stomach contents		0.600	1.06(21)	<16	37(29)	17.7(7)	.033(50)	.90(20)	
6464		viscera		0.474	1.49(5)	<4	23(7)	12.5(5)	.022(25)	.39(9)	
6465		skin		0.474	2.46(3)	<4	6.3(16)	0.91(10)	.079(40)	.06(60)	
6466		liver		0.247	1.46(15)	<13					
6455	H-5	muscle		0.233	2.95(2)	<2		0.14(15)	.043(37)		
6456		bone		0.568	.76(25)	<9		2.84(10)	.040(65)		
6457		stomach contents		0.579	1.24(20)	<18		9.61(8)	.034(25)	<0.18	
6458		viscera		0.470	1.55(6)	<4		6.81(2)	.026(8)		
6459		skin		0.498	2.39(4)	<5		0.85(8)	.039(40)		
6460		liver		0.251	2.32(32)	<33		18.6(5)	.040(30)	<0.27	
Name: Snapper											
6467	H-1	muscle		0.224	4.81(1)	18.3(3)	<0.2	<.004	<.1	<.1	
6468		bone		0.599	0.96(13)	<4	8.6(7)	0.11(50)	<.5	1(90)	
6469		stomach contents	lost								
6470		viscera		0.219	2.60(5)	<3	<9	0.8(50)	<.4	3(80)	
6471		skin		0.365	3.65(2)	<4	<2	0.17(40)	<.3	<.2	
6472		liver		0.264	2.84(13)	<18					

TABLE 19. (continued) Concentrations of Radionuclides in Fish Tissue - Taka Atoll
pCi/kg wet weight

Sample Island ID	locator	Tissue	Dry/wet		137Cs	90Sr	239+240Pu	238Pu 239+240Pu	241Am 239+240Pu	Others
			Weight	x 10 ⁻³						
Name: Jack										
6473	H-1	muscle	0.250	4.23(2)	38.4(8)	0.23(32)	.007(50)	<1	<1	
6474		bone	0.651	1.03(10)	<5	14(37)	.07(43)	<.5	<1	
6475		stomach contents								
6476		viscera	0.260	2.61(3)	19(16)	<2	.23(20)	.1(50)	.65(50)	
6477		skin	0.416	2.88(3)	31(18)	5(27)	<.02	<1		
6478		liver	0.272	2.61(6)	<9					

Island Locator	Common Name	Scientific Name	Number of Individuals Pooled/ Sample	Average Whole Body Wet Weight (gm)	Average Standard Length (mm)	Male	Female
J-22	Surgeonfish	<u>Acanthurus triostegus</u>	20	31±7	84±4	13	7
J-22	Mullet	<u>Chelon sp.</u>	17	49±8	127±7	17	0
J-5	Goatfish	<u>Mulloidichthys samoensis</u>	26	169±44	198±17	10	16
J-18	Goatfish	<u>Mulloidichthys samoensis</u>	31	163±35	195±15	10	21
J-5	Jack	<u>Carangoides sp.</u>	14	345±51	265±13	14	0
Lagoon	Ulua	<u>Coranx sp.</u>	1	1699	430	0	1

TABLE 21. Concentrations of Radionuclides in Fish Tissue - Ujelang Atoll
pCi/kq wet weight

Sample Island	Dry/wet 40k	137Cs	90Sr	239+240Pu	238Pu 239+240Pu	241Am 239+240Pu	Others
ID locator Tissue	Weight x10 ⁻³						
Name: Surgeonfish							
6844 J-22 muscle	0.226	<6	0.3(60)	<.002	<1	<1	
6845 bone	0.579	<15	12(46)	1.6(27)	<.2	.23(60)	
6846 stomach contents	0.206						
6847 viscera	0.169	23(35)	4(60)	2.6(11)	<.5	.08(70)	
6848 skin	0.364	<14	14(6)	0.6(60)	<.5	<.8	
6849 liver	0.209						
Name: Mullet Chelon							
6838 J-22 muscle	0.228	<4		<.018	<1	<0.5	
6839 bone	0.477			-10(48)	<1		
6840 stomach contents	0.516			8.3(6)		.033(40)	
6841 viscera	0.329	<11		3.6(5)		.022(43)	
6842 skin	0.518	<12		.06(40)			
6843 liver	0.216	<41		2.6(23)			113mCd 45(40)
Name: Goatfish							
6850 J-5 muscle	0.229	6.0(10)	<0.2	<.003	<1	<1	
6851 bone	0.540	<3	19(7)	.13(50)	<.5	0.9(90)	
6852 stomach contents	0.138	<45					
6853 viscera	0.315	<5	4(62)	2.1(19)	<.1	0.18(60)	
6854 skin	0.511	<3	3.0(12)	<.03	<1	<1	
6855 liver	0.222	<12					
6864 J-18 muscle	0.235	8.5(15)	<0.2	<.004	<1	<1	
6865 bone	0.559	<2	16(8)	<.1	<1		
6866 stomach contents	0.174	<40					
6867 viscera	0.296	<3	<2	0.36(36)	<.3	0.3(75)	
6868 skin	0.504	<4	5.9(20)	<.05	<1	<1	
6869 liver	0.233	<12					60Co 24(60)
Name: Jack							
6871 J-5 muscle	0.230	15.4(2)	<0.2	<.006	<1	<1	
6872 bone	0.580	<3	12(13)	0.66(26)	0	3(40)	0 14 70
6873 stomach contents	0.251	<8	<7	<.2	<1	<1	
6874 viscera	0.235	15(22)	<3	<.08	<1	<1	
6875 skin	0.349	21(34)	<3	<.16	<1	<1	
6876 liver	0.219	<10					

TABLE 21. (continued) Concentrations of Radionuclides in Fish Tissue - Ujelang Atoll
pCi/kg wet weight

Sample Island ID	locator	Tissue	Dry/wet Weight $\times 10^{-3}$	^{40}K	^{137}Cs	^{90}Sr	$^{239+240}\text{Pu}$	$\frac{^{238}\text{Pu}}{^{239+240}\text{Pu}}$	$\frac{^{241}\text{Am}}{^{239+240}\text{Pu}}$	Others
Name: Ulua										
6877	J-18	muscle	0.244	3.86(4)	24.4(2)	<0.4			<1	
6878		bone	0.656	0.98(20)	<10	12(9)	.04(40)	<.5	<1	
6879		stomach contents	0.158				<.2	<.5		
6880		viscera	0.253	3.44(8)	19(40)	16(32)	<.07	<1		^{60}Co 24(42)
6881		skin	0.437	2.59(8)	29(32)					
6882		liver	0.248	3.73(6)	28(28)					

TABLE 22. Fish Collections - Utirik Atoll

Island Locator	Common Name	Scientific Name	Number of Individuals Pooled/ Sample	Average Whole Body Wet Weight (gm)	Average Standard Length (mm)	Male	Female
I-8	Surgeonfish	<u>Acanthurus triostegus</u>	3	152±32	141±11	0	3
I-1	Goatfish	<u>Mulloidichthys samoensis</u>	76	85±24	164±12	73	3
I-8	Parrotfish	<u>Scarus sordidus</u>	1	680	270	1	0
I-8	Threadfin	<u>Polydactylus sexfilis</u>	7	847±255	322±28	4	3
I-2	Flagtails	<u>Khulia taeniura</u>	23	123±20	176±10	9	14
Lagoon	Grouper	<u>Cephalopholis argus</u>	1	853	378	1	0
I-7	Grouper	<u>Epinephelus kohleri</u>	1	2549	480	0	1

TABLE 23. Concentrations of Radionuclides in Fish Tissue - Utirik Atoll
pCi/kg wet weight

Sample Island ID	locator	Tissue	Dry/wet Weight	40K x10 ⁻³	137Cs	90Sr	239+240Pu	238Pu / (239+240Pu)	241Am / (239+240Pu)	Others
Name: Surgeonfish										
6921	I-8	muscle	0.215	2.72(4)	23.7(6)	<1	0.4(60)	<1	<.2	
6922		bone	0.618	<19	<9	12(20)	.33(40)	<1	.10(30)	
6923		stomach contents	0.087							
6924		viscera	0.136	2.08(7)	16(28)	<3	9.9(7)	.034(70)	.05(30)	
6925		skin	0.389		<13		6.8(14)	<.05	.14(80)	
6926		liver	0.237							
Name: Goatfish										
6927	I-1	muscle	0.225	0.57(15)	6.2(8)		<.005	<1	<1	
6928		bone	0.511	<4			.04(53)	<1		
6929		stomach contents	0.212				.93(35)	<1		
6930		viscera	0.310	2.83(6)	<6		2.82(2)	.016(14)	0.47 30	
6931		skin	0.461	3.10(4)	<3		.06(60)	<1		113mCd 42(14)
6932		liver	0.222	3.97(6)	<8		0.62(26)	<1		
Name: Parrotfish										
6939	I-8	muscle	0.199			<1	.06(67)	<1	<.3	
6940		bone	0.572			12(44)	<.3	<1	<1	
6941		stomach contents	0.453							
6942		viscera	0.370			2.0(37)	0.43(9)	.03(80)	0.74(20)	
6943		skin	0.441			14(41)	<.8	<1	<1	
6944		liver	0.283							
Name: Threadfin										
6909	I-8	muscle	0.223	3.32(1)	15.5(6)	<0.3	<.01	<1	<1	
6910		bone	0.595	0.38(10)	<2	12(11)	<.03	<1	<1	
6911		stomach contents	0.095	2.68(25)	<31					
6912		viscera	0.303	2.57(3)	8(24)	<1				
6913		skin	0.467	2.46(4)	<3	4.6(17)	<.10	<1	<1	
6914		liver	0.298	4.23(5)	<8					
Name: Flagtail										
6915	I-2	muscle	0.244	3.18(1)	4.1(10)	<0.3	<.02	<1	<1	
6916		bone	0.669	4.03(3)	<6	11(12)	<.1	<1	<1	
6917		stomach contents	0.180							
6918		viscera	0.348	2.70(4)	<4	<2	.18(60)	.7(80)	.8(80)	
6919		skin	0.590	<3	<3	5.7(19)	<.02	<1	<1	
6920		liver	0.300	3.10(9)	<13					

TABLE 23. (continued) Concentrations of Radionuclides in Fish Tissue - Utirik Atoll
pCi/kg wet weight

Sample Island ID	locator	Tissue	Dry/wet Weight x10 ⁻³	40K	137Cs	90Sr	239+240Pu	238Pu 239+240Pu	241Am 239+240Pu	Others
Name: Grouper										
6945	lagoon	muscle	0.207		24.3(3)	<0.6	<.01	<.1	<.1	
6946		bone	0.648		17(13)	<.01	<.1	<.1		
6947		stomach contents	0.111							
6948		viscera	0.239							
6949		skin	0.393		<6	.11(50)	<.5		1.0(80)	
6950		liver	0.291							
Name: Grouper										
6951	I-7	muscle	0.222	3.84(1)	16.6(7)	<0.2	<.001	<.1	<.1	
6952		bone	0.684		13(18)		.12(43)	.5(80)		
6953		stomach contents	0.070							
6954		viscera	0.347 ^u	1.63(6)	9(42)	<3	<.04	<.1	<.4	
6955		skin	0.475	1.79(6)	<6	<.4	<.11	<.1	<.2	
6956		liver	0.312	2.33(8)	<9					

TABLE 24. Fish Collections - Motho Atoll

Island Locator	Common Name	Scientific Name	Number of Individuals Pooled/Sample	Average Whole Body Wet Weight (gm)	Average Standard Length (mm)	Male	Female
M-12	Surgeonfish	<u>Acanthurus triostegus</u>	41	61±11	103±10	12	29
M-17	Surgeonfish	<u>Acanthurus triostegus</u>	89	59±14	104±10	49	40
M-17	Mullet	<u>Crenimugil crenilabis</u>	3	591±66	290±15	1	2
M-1	Mullet	<u>Neomyxus chaptalii</u>	55	130±40	184±16	43	12
M-12	Mullet	<u>Neomyxus chaptalii</u>	37	209±45	195±30	25	12
M-1	Goatfish	<u>Mulloidichthys samoensis</u>	22	145±22	188±19	19	3
M-17	Goatfish	<u>Mulloidichthys samoensis</u>	43	181±37	196±14	9	34
M-1	Parrotfish	<u>Scarus sordidus</u>	4	552±218	243±33	0	4
M-12	Parrotfish	<u>Scarus sordidus</u>	4	494±111	238±15	2	2
Lagoon	Rainbow Runner	<u>Elegatis sp.</u>	1	3006	635	0	1
Lagoon	Snapper	<u>Aprion virescens</u>	1	2113	497	1	0

TABLE 25. Concentrations of Radionuclides in Fish Tissue Motho Atol
pCi/kg wet weight

Sample Island	ID locator	Tissue	Dry/wet Weight x 10 ⁻³	40K	137Cs	90Sr	239+240Pu	238Pu	241Am	Others
							239+240Pu	239+240Pu	239+240Pu	
Name: Surgeonfish										
	6615	M-12 muscle	0.215	3.83(1)	21(7)					
	6616	bone	0.608	0.49(17)	<3					
	6617	stomach contents	0.082	2.12(7)	<7					
	6618	viscera	0.125	2.11(2)	9.4(9)					
	6619	skin	0.418	3.25(4)	23(19)					
	6620	liver	0.267	2.64(16)	<16					
	6603	M-17 muscle	0.217	4.16(1)	20.3(5)	<0.2	0.041(24)	<0.04	<.05	
	6604	bone	0.604	0.55(13)	<3	13.2(3)	4.0(10)	<.03	0.68(3)	
	6605	stomach contents	0.102	2.21(5)	<5	<3	0.31(30)	<.5	1.2(60)	
	6606	viscera	0.162		5(36)	1.5(42)	1.8(6)	0.043(35)	0.11(30)	
	6607	skin	0.359	3.67(1)	34(4)	<2	1.8(5)	0.067(20)	<.01	
	6608	liver	0.251	3.15(10)	<15					
Name: Mullet <u>Crenimugil</u>										
	6591	M-17 muscle	0.238	3.73(1)	11(11)	<0.4	0.035(33)	<.3	0.8(70)	
	6592	bone	0.674	1.90(9)	<9	<18	2.5(11)	<.1	<0.2	
	6593	stomach contents	0.636		<32	44(30)	14.1(11)	<.05	0.47(28)	
	6594	viscera	0.364	1.72(4)	7(43)	4.3(24)	5.1(5)	0.043(20)	0.61(12)	
	6595	skin	0.597	2.26(6)	<6	6.1(25)	0.6(17)	0.16(60)	<.2	
	6596	liver	0.261	2.56(17)	<21					
Name: Mullet <u>Neomyxus</u>										
	6574	M-1 muscle	0.233	3.12(1)	5.8(7)					
	6575	bone	0.590	0.56(21)	<5		0.10(12)	0.038(60)	0.1	60
	6576	stomach contents	0.501		<20		3.07(6)	0.048(26)	<0.07	
	6577	viscera	0.383	2.02(3)	<2		22.0(3)	0.034(15)		
	6578	skin	0.526	3.43(3)	7.4(37)		3.49(3)	0.043(7)		
	6579	liver	0.250	2.93(6)	<5		0.84(8)	0.05(50)		
	6580	M-12 muscle	0.235	2.27(1)	4.1(20)	<0.4	11.0(3)	0.065(11)	0.02(15)	
	6581	bone	0.582	0.51(8)	<3	11(10)	0.13(10)	0.09(60)	0.14(60)	
	6582	stomach contents	0.571	1.17(35)	<25	<14	3.6(13)	0.23(30)	<.01	
	6583	viscera	0.415	1.41(3)	<2	2.8(30)	11.4(6)	0.043(50)	0.80(20)	
	6584	skin	0.513	2.65(6)	<3	4.1(7)	5.6(3)	0.041(15)	0.37(15)	
	6585	liver	0.272	4.09(5)	<8		0.91(8)	0.082(35)	0.07(50)	

¹⁴⁴Ce 113(40)
⁶⁰Co 2.6(32) ¹⁴⁴Ce 153(5)

¹⁴⁴Ce 681(18)
¹⁴⁴Ce 204(6)
⁶⁰Co 19(78)

TABLE 25. (continued) Concentrations of Radionuclides in Fish Tissue - Motho Atoll
pCi/kg wet weight

Sample Island	Dry/wet	^{40}K	^{137}Cs	^{90}Sr	$^{239+240}\text{Pu}$	^{238}Pu	^{241}Am	Others
ID locator	Tissue	Weight $\times 10^{-3}$				$^{239+240}\text{Pu}$	$^{239+240}\text{Pu}$	
Name: Goatfish								
6621	M-1 muscle	0.227	3.51(1)	<0.4	<.003	<1	<1	
6622	bone	0.545	.68(14)	24(14)	<0.1	<1	<1	
6623	stomach contents	0.139						
6624	viscera	0.259	1.45(4)					
6625	skin	0.550	4.33(4)	<2	0.56(16)	.17(60)		
6626	liver	0.263	5.38(9)	6.1(21)	<.03	<1	<1	
6633	M-7 muscle	0.228	3.59(1)	<.1	<.01	<1	<1	
6634	bone	0.588	0.59(9)					
6635	stomach contents	0.259	2.73(16)	<19				
6636	viscera	0.346	2.58(4)	<2				
6637	skin	0.521	3.39(5)	5.1(19)	<.03	<1	<1	
6638	liver	0.265	4.66(4)	<6				^{60}Co 23(33)
Name: Parrotfish								
6597	M-1 muscle	0.201	4.13(1)	<0.5	.02(80)	<.5		
6598	bone	0.576	0.89(12)	9.5(12)	1.3(17)	.11(70)	.37(60)	
6599	stomach contents	0.286	1.61(37)	<33				
6600	viscera	0.405	1.12(5)	11.8(15)	4.37(4)	.027(25)	.43(15)	
6601	skin	0.478	2.96(5)	6.7(38)	0.82(15)	.15(70)	<.1	^{60}Co 14(31)
6602	liver	0.611		<9				
6609	M-12 muscle	0.345	3.81(1)	13.1(11)				
6610	bone	0.540	1.13(13)	14(9)	1.1(15)	<.06	.78(30)	
6611	stomach contents	0.430						
6612	viscera	0.402	2.03(4)	9(19)	5.1(4)	.033(27)	.62(10)	
6613	skin	0.457	2.48(3)	7(38)				
6614	liver	0.574	1.06(12)	<6				
Name: Rainbow runner								
6627	lagoon muscle	0.246	2.04(1)	21.9(3)	<.003	<1	<1	
6628	bone	0.651	0.92(8)	10.2(25)	<.03	<1		
6629	stomach contents	0.239						
6630	viscera	0.272	9.8(25)					
6631	skin	0.462	3.2(6)	<9	<.006	<1	<1	
6632	liver	0.411						

TABLE 25. (continued) Concentrations of Radionuclides in Fish Tissue - Wotho Atoll
pCi/kg wet weight

Sample ID	Island	Tissue	Dry/wet Weight x 10 ⁻³	⁴⁰ K	¹³⁷ Cs	⁹⁰ Sr	²³⁹⁺²⁴⁰ Pu	²³⁸ Pu / ²³⁹⁺²⁴⁰ Pu	²⁴¹ Am / ²³⁹⁺²⁴⁰ Pu	Others
6639	agoon	muscle	0.234		17.3(3)	6.6(32)	<.006	<1		
6640		bone	0.693				<.04	<1		
6641		stomach contents	0.069							
6642		viscera	0.253	2.13(8)	<5	<3	.02(70)	<1		60Co 10(43)
6643		skin	0.553	4.30(3)	15(41)	6(49)	.035(50)	<1		
6644		liver	0.305	1.46(13)	<8					

TABLE 26. Concentrations of Anthropogenic Radionuclides in pCi/kg Wet Weight of Fish Muscle Collected from Northern Marshall Island Atolls During 1978.

Atoll	Total # fish	Species	#	⁹⁰ Sr		¹³⁷ Cs	
				Range	Mean	Range	Mean
Likiep	294	mullet	26	0.3 - <1.0	0.7	6.6 - 7.4	7.0
		surgeonfish	98	1.0 - <3.0	1.9	7.0 - 23	16.0
		goatfish	109	<.2 - 0.7	0.4	5.0 - 7.6	6.2
		parrotfish	23	-	<0.6	10 - 14	12.2
		rabbitfish	25	-	<0.3	-	11.4
Taka	132	mullet	70	0.3 - 0.6	0.5	3.3 - 3.4	3.3
		surgeonfish	59	0.3 - 0.8	0.5	11 - 17	14
		large carnivores	3	-	0.2	19 - 34	28
		mullet	36	-	<0.6	5.8 - 13.9	9.3
		surgeonfish	142	* 2 - 1.1	0.8	19 - 27	23.0
Ailinginae	283	goatfish	92	.2 - 0.4	0.3	6.9 - 7.2	7.0
		parrotfish	9	-	0.2	-	18
		large carnivores	4	<.2 - <.5	<0.3	14 - 35	22
		mullet	95	-	<0.4	8.1 - 10	8
		surgeonfish	130	-	<0.2	20 - 22	21
Wotho	300	goatfish	65	<.1 - <.4	<0.2	6.6 - 7.2	6.9
		parrotfish	8	-	<0.5	13 - 16	15
		large carnivores	2	-	0.2	18-22	20
		mullet	70	-	.15	5.7 - 6.2	6.0
		surgeonfish	62	<.2 - <1.0	<.5	22 - 25	23
Bikar	44	parrotfish	8	<.8 - 1.0	0.9	21 - 24	23
		large carnivores	4	<.1 - .6	0.4	24 - 28	26
		mullet	32	-	<0.4	5.9 - 7.7	7
		surgeonfish	41	<.7 - <.1	<0.8	11 - 20	15
		goatfish	99	<.1 - <.5	<0.3	5.7 - 7.2	6
Ailuk	73	large carnivores	1	-	<0.7	-	16
		mullet	35	-	<0.3	5.3 - 7.4	6.4
		surgeonfish	221	<.2 - .6	.36	14 - 20	17.5
		goatfish	19	-	0.8	-	8.3
		parrotfish	2	-	<.6	-	15.4
Rongerik	29 ^a	treadfin	6	-	.45	-	16.3
		large carnivores	7	-	<.3	14 - 40	25
		mullet	20	-	0.2	-	5.9
		surgeonfish	57	-	<.16	5.6 - 6.9	6.3
		goatfish	87	-	<.03	16 - 24	20

TABLE 26. (continued) Concentrations of Anthropogenic Radionuclides in pCi/kg Wet Weight of Fish Muscle Collected from Northern Marshall Island Atolls During 1978.

Atoll	Total # fish	Species	#	⁹⁰ Sr		¹³⁷ Cs	
				Range	Mean	Range	Mean
Utirik	113	surgeonfish	3	-	<1.5	-	23
		goatfish	76	-	lost	-	6.2
		parrotfish	1	-	<1.4	-	-
		rudderfish	23	-	<0.3	-	3.9
		treadfin	7	-	<0.3	-	15
large carnivores	3	-	<0.4	5 - 24	20		
Mejit	70	rudderfish	70	-	-	-	6.8
Jemo	99	surgeonfish	71	-	<2	14 - 21	18
		treadfin	28	-	<.07	-	15
Rongelap	605	mullet	74	0.5 - 2.0	0.9	16 - 133	42
		surgeonfish	276	<.2 - 1.1	0.7	18 - 55	33
		goatfish	233	.3 - 2.8	1.0	7 - 8.5	7.6
		parrotfish	15	-	<0.1	-	16.3
		large carnivores	7	<.2 - <.6	<0.3	12 - 62	28

TABLE 26. (Continued) Concentrations of Anthropogenic Radionuclides in pCi/Kg Wet Weight of Fish Muscle Collected from Northern Marshall Island Atolls During 1978.

Atoll	Total # Fish	Species	#	238Pu			239+240Pu			241Am			Other		
				Range	Mean	Range	Mean	Range	Mean	Range	Mean				
Likiep	294	mullet	26	-	<.005	.03	.04	.035	<.003	.02	.01				
		surgeonfish	98	-	<.04	.03	.07	.06	-	<.02					
		goatfish	109	-	<.05	<.003	.02	.013	-	<.005					
		parrotfish	23	<.004	.07	.01	1.4	.08	-	<.05					
		rudderfish	25	-	.02	-	.04	-	.007						
rabbitfish	25	-	<.01	-	<.01	-	<.02								
Taka	132	mullet	70	<.005	.02	.13	.19	.15	<.006	.03	.02				
		surgeonfish	59	-	<.03	.05	.12	.08	<.006	.04	.02				
		large carnivores	3	-	<.01	<.004	.007	.005	-	<.003					
Ailinginae	283	mullet	36	<.007	.07	.14	.24	.20	<.007	.02	.015				
		surgeonfish	142	<.01	.09	.05	.19	.12	<.10	.08	.04				
		goatfish	92	<.01	<.03	.01	0.3	.02	-	<.01					
		parrotfish	9	-	.02	-	.07	-	<.002						
		large carnivores	4	<.006	<.02	<.008	.02	.01	<.002	.02	<.008				
Wotho	300	mullet	95	.005	.012	.04	.13	.10	.01	.03	.02				
		surgeonfish	130	-	<.003	-	.04	.04	-	<.002					
		goatfish	65	<.009	<.02	<.003	<.01	<.006	<.007	<.009	<.008				
		parrotfish	8	-	<.01	-	.02	.02	-	<.02					
		large carnivores	2	<.001	<.008	<.003	<.006	<.004	.002	.004	.003				
Bikar	144	mullet	70	-	.008	-	.016	.016	-	lost					
		surgeonfish	62	<.004	.04	<.004	.04	.02	<.006	.06	.03				
		parrotfish	8	<.008	.03	<.008	.05	.03	<.01	.03	.02				
		large carnivores	4	<.001	<.003	.009	.012	.01	-	<.01					
Ailuk	173	mullet	32	.005	.05	-	.06	.06	-	<.01					
		surgeonfish	41	<.01	.05	<.03	.08	.05	<.008	.01	<.01				
		goatfish	99	-	<.009	-	<.01	<.01	<.001	.10	<.005				
		large carnivores	1	-	<.02	-	<.02	-	-	.005					
Rongerik	290	mullet	35	-	<.01	.07	.30	.18	-	<.004					
		surgeonfish	221	<.002	.01	.01	.15	.09	<.005	.02	.01				
		goatfish	19	-	<.01	-	.024	.015	-	.015					
		parrotfish	2	-	<.02	-	<.007	-	-	<.01					
		treadfin	6	-	<.003	-	<.003	-	-	<.008					
large carnivores	7	<.003	.02	.005	<.01	.01	-	<.006							
Ujelang	164	surgeonfish	20	-	<.002	-	<.002	<.002	-	<.009					
		goatfish	57	-	<.005	-	<.003	<.003	-	<.004					
		large carnivores	87	-	<.005	<.006	.04	.02	-	<.01					

TABLE 26. (Continued) Concentrations of Anthropogenic Radionuclides in pCi/Kg Wet Weight of Fish Muscle Collected from Northern Marshall Island Atolls During 1978.

Atoll	Total # fish	Species	#	238Pu			239+240Pu			241Am			Other	Range	Mean	Range	Mean
				Mean	Range	#	Mean	Range	#	Mean	Range	#					
Utirik	113	surgeonfish	3	<.02	-	<.001	0.4	-	<.001	-	<.06	-	<.001	-	<.06	-	<.001
		goatfish	76	<.06	-	<.06	<.001	-	<.02	-	<.01	-	<.01	-	<.01	-	<.01
		parrotfish	1	<.02	-	<.02	<.01	-	<.01	-	<.01	-	<.01	-	<.01	-	<.01
		rudderfish	23	<.01	-	<.01	<.01	-	<.01	-	<.01	-	<.01	-	<.01	-	<.01
		large carnivores	3	<.01	-	<.01	<.01	-	<.01	-	<.01	-	<.01	-	<.01	-	<.01
Mejit	70	rudderfish	70	<.001	-	<.001	<.002	-	<.002	-	-	-	-	-	-	-	-
		surgeonfish	71	<.03	-	<.003	.09	.13	.09	.09	.09	.09	.09	.09	.09	.09	.09
Jemo	99	surgeonfish	28	<.003	-	<.003	.002	-	.002	-	.002	-	.002	-	.002	-	.002
		treadfin	71	<.003	-	<.003	.002	-	.002	-	.002	-	.002	-	.002	-	.002
Rongelap	605	mullet	74	.013	<.003 - .04	.013	0.72	1.3	.013	.013	.12	.12	.12	.12	.12	.12	.12
		surgeonfish	276	.020	<.003 - .04	.020	.32	.47	.32	.32	.13	.13	.13	.13	.13	.13	.13
		goatfish	233	.02	<.007 - .02	.02	.024	.04	.024	.024	.02	.02	.02	.02	.02	.02	.02
		parrotfish	15	.01	-	.01	.15	-	.15	-	.15	-	.15	-	.15	-	.15
		large carnivores	7	.02	.007 - <.03	.02	.006	.009	.006	.006	<.001	<.02	<.001	<.02	<.001	<.02	<.001

TABLE 27. Summaries of Average Concentrations in Fish Flesh.^a
pCi/kg wet weight

Atoll	All reef fish ^b			All lagoon pelagic fish ^c				
	137Cs	90Sr	239+240Pu	241Am	137Cs	90Sr	239+240Pu	241Am
Likiep	11 ± 4	0.7 ± 0.6	.04 ± .03	.2 ± .02	28	<0.2	.005	<.003
Taka	9 ± 7	0.5	.12 ± .05	.2 ± .02	22	<0.3	.01	<.008
Ailinginae	14 ± 7	0.5 ± 0.3	.10 ± .07	.2 ± .02	20	0.2	<.004	.003
Wotho	13 ± 6	<0.3	.04 ± .04	.1 ± .01	26	0.4	.01	<.01
Bikar	17 ± 9	0.5 ± 0.4	.04 ± .04	.1 ± .01	16	<0.7	<.02	.005
Ailuk	9 ± 5	<0.5	.04 ± .03	<.01	25	<0.3	.014	<.006
Rongerik	13 ± 5	0.5 ± 0.3	.07 ± .07	.09 ± .04	20	<0.3	.02	<.01
Ujelang	6 ± 1	0.2 ± 0.1	<.003	<.05				
Mejit	7		<.002					
Jemo	16 ± 2	<1	.04 ± .04	<.08	28	<0.3	.006	.006
Rongelap	24 ± 15	0.7 ± 0.4	.30 ± .30	.03 ± .03				
					239+240Pu			
					Remaining Atolls			
surgeonfish		22 ± 11	0.8 ± .6	0.31 ± .22	.09 ± .08		.021 ± .026	
mullet		10 ± 8	0.5 ± .3	0.70 ± .51	.11 ± .08		.056 ± .058	
goatfish		7 ± 2	0.5 ± .6				.014 ± .014	
parrotfish		16 ± 4	0.5 ± .4				.011 ± .008	
remaining reef fish		10 ± 5	0.3 ± .2					
all pelagic lagoon fish		23 ± 8	0.3 ± .2					

a All limit values for individual samples treated as positive numbers for averaging unless all concentrations were less than maximum indicated.

b Includes surgeonfish, mullet, goatfish, rudderfish, parrotfish, threadfin, rabbitfish, flagtails.

c Includes mackerel, jacks, groupers, snapper, rainbow runner, ulua, bonito, tuna.

TABLE 28. Concentrations of Radionuclides in Different U.S. Marine Dietary Foods.
pCi/kg wet weight

<u>Sample description - commercial fresh fillets</u>	Year	⁹⁰ Sr	¹³⁷ Cs	²³⁹⁺²⁴⁰ Pu	²⁴¹ Am	Reference and notes
New York City diet,	1978	0.6				13
New York City diet,	1979	0.6				14
San Francisco City diet	1978	0.3				13
San Francisco City diet	1979	0.3				14
Chicago City diet	1978		20 ± 5			15, 16 (April and October collections averaged)
New York City diet	1974			.0017		17
Imported fish to U.S.	1971-77	2.0	24			18 (includes fresh, frozen and canned imported fish-personnal communications with senior authors)
Turbot fillets, Oregon market	1979	<0.4	15	.022	<.02	Unpublished results this lab
Squid, San Francisco market	1980			.06		" " " "
Mullet fresh, from North Carolina coastal area	1979		9	<.07		" " " "
Other edible fish (as samples)						
Albacore, near San Diego, CA.	1977		30			14
Snapper, outside San Francisco Bay, CA	1977		17 ± 2	.008 ± .003		20
<u>Shellfish - soft parts</u>						
New York City diet	1974			.04		17
New York City diet	1978	1.4				13
New York City diet	1979	1.5				14
San Francisco City diet	1978	0.5				13
San Francisco City diet	1979	0.8				14
East and Gulf Coast invertebrates	1976		1.3	.09	.02	21 (includes mytilus edulis; crassostrea virginica; Ostrea equestris)
West coast invertebrates	1976-77		1.6	.15	.36	21

TABLE 29. Concentrations of Radionuclides in Flesh of Marine Fish Outside United States.
pCi/kg wet weight

Sample description	Year	90Sr	137Cs	239+240Pu	241Am	Reference and notes
From commercial landings at Whitehaven, Fleetwood, Morecambe Bay, United Kingdom	1977	9100	1.1	0.9	22 (includes plaice, cod flounder, herring and mackerel)	
Irish Republic	1977	2600			22 (includes plaice and cod)	
Northern North Sea	1977	120			22 (includes plaice, cod, herring, sand ell)	
Offshore Tokai, Japan	1971-75	0.9	7.5	.099	23 includes flounder and flat fish)	
Meso pelagic fishes Pacific offshore Japan	1978-79	19			24 (includes <u>Sebastes</u> <u>malsuburai</u> , <u>Scombrops</u> <u>boops</u> , <u>Hyperoglyphe</u> <u>japonica</u> , <u>Paracaesio</u> <u>caeruleus</u> , <u>Beryx</u> <u>splendens</u>)	
Coastal fishes - Pacific offshore Japan	1978-79	18			24 (includes <u>Paralichthys</u> <u>oblongus</u> , <u>Lotella</u> <u>maximoniczi</u> , <u>Latrola</u> <u>japonicus</u> , <u>Katsuwonus</u> <u>argenteus</u>)	

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