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Species and Age of Fish Aboard the *Cyi Yang No. 1* as Determined from Scales Scraped from the Freezers, Hold, and Fishing Gear

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SPECIES AND AGE OF FISH ABOARD THE CYI YANG NO. 1 AS DETERMINED FROM SCALES SCRAPED FROM THE FREEZERS, HOLD, AND FISHING GEAR

by

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INTRODUCTION

On 17 April 1989, the Taiwanese gill-net FV Cyi Yang No. 1 was sighted by U.S. Coast Guard personnel aboard the Coast Guard vessel Jarvis in fishing position at 45°30'N 166°01'E, approximately 500 miles southwest of Attu Island in the Aleutian Islands. The Taiwanese abandoned their nets and departed. The Jarvis followed the Cyi Yang No. 1 for 3 days before the vessel stopped and was boarded by Coast Guard personnel. The Coast Guard lost sight of the vessel during episodes of dense fog. There were no fish on board the vessel at the time of boarding, therefore a Coast Guard officer took samples of flesh and scales by scraping the fishing gear, and the walls and floors of the net well, freezers, and holds. Because of concern in the United States about interception of U.S. salmon by foreign high seas gill-net fisheries, the samples were given to me for analysis as to species, age, and country of origin. This is a report of my findings.

METHODS

On 3 May 1989, J. Craig Hammond, Special Agent, in charge of NOAA Fisheries Enforcement in Alaska, delivered the frozen samples to me at the National Marine Fisheries Service (NMFS) Auke Bay Laboratory. Three NMFS personnel helped me process the samples from 8 May to 10 May 1989.

Seven samples (three from the port freezer, and one each from the starboard freezer, forward net reel, net feeder pipe, and aft net well) were taken from the vessel and each was

placed in a zip-type plastic bag. Of the port freezer samples, one contained a reddish liquid, probably blood, and another contained what looked like flesh. There were no scales in these two bags and the contents in both were putrid. All of the other bags contained scales.

We emptied each bag into labelled petri dishes that contained water and viewed the contents under binocular dissecting microscopes. We cleaned each scale with a clipped artist's brush and mounted them between glass microscope slides (up to ten scales per slide). We mounted all the scales from each bag except those from the aft net-well bag; this bag contained many more scales than needed for analysis, therefore we mounted approximately one-half of them.

Scales were viewed and analyzed on an Eberbach[1] scale projector at 81-dia magnification. I identified the scales to species and age when possible. To verify my interpretations of the scales, I took seven slides of representative scales to the Alaska Department of Fish and Game (ADF&G) regional office (802 Third St., Douglas, AK), where fishery biologists who specialize in salmon scale analysis viewed the scales on 11 May.

I sent about one-half of the scales to a salmon scale specialist with the Fisheries Research Institute, University of Washington, Seattle, Washington. I asked for an independent opinion on the feasibility of using scale characters to estimate continent of origin.

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[1]Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

The European Method of ageing the scales was used. This method uses a decimal system: the number of freshwater annuli are on the left side of the decimal and the number of marine annuli are on the right side of the decimal. Total age of the salmon is one plus the numbers on each side of the decimal. Salmon are usually aged from conception, and the time between conception and the time of scale formation is approximately 1 year.

RESULTS

We mounted 608 scales: 12 from the forward net reel, 24 from the net feeder pipe, 53 from the starboard freezer, 58 from the port freezer, and 461 from the aft net well (Table 1). All scales were cycloid type except one that was ctenoid.

Species was identified from 502 scales--257 were chum salmon (Oncorhynchus keta) and 245 were sockeye salmon (O. nerka) (see Mosher, 1969). A total of 106 scales were not identified to species.

Age composition varied in scales of both species (Table 1). Chum age varied between 0.1 and 0.4; 64% of the total chum were 4-yr-olds (0.3) and 35% were 3-yr-olds (0.2). Most of the unaged scales were regenerate.

The majority of the sockeye scales came from four age groups: 1.2, 1.3, 2.2, and 2.3 (Table 1). The 2.3 age group (6-yr-olds) was 30% of the total sockeye, the 2.2 age group (5-yr-olds) was 21%, the 1.3 age group (5-yr-olds) was 29%, and the 1.2 age group (4-yr-olds) was 16%.

Table 1.--Species identification and age group classification (European) of scales sampled from various locations on the gill-net vessel Cyi Yang No. 1.

Location on vessel	Chum salmon (age)					
	0.1	0.2	0.3	0.4	Unaged	Total
Forward net reel	0	2	1	2	0	5
Net feeder pipe	0	2	2	0	0	4
Starboard freezer	0	4	11	1	3	19
Port freezer	1	19	21	0	1	42
Aft net well	1	61	111	1	13	187
Totals	2	88	146	4	17	257

	Sockeye salmon (age)								
	0.3	1.1	1.2	1.3	2.1	2.2	2.3	Unaged	Total
Forward net reel	0	0	0	0	0	4	2	1	7
Net feeder pipe	0	1	1	0	0	1	0	0	3
Starboard freezer	0	0	1	2	2	6	10	2	23
Port freezer	0	0	1	3	0	1	8	1	14
Aft net well	3	0	24	43	1	31	44	52	198
	3	1	27	48	3	43	64	56	245

	Unidentified species	Grand total
Forward net reel	0	12
Net feeder pipe	17	24
Starboard freezer	11	53
Port freezer	2	58
Aft net well	76	461
	106	608

Of the 70 scales viewed by ADF&G, one scale that we all were uncertain about as to species identification may have been from a chinook salmon (O. tshawytscha). There were several other scales that we could not assign to species; however, we all agreed that they were probably salmon scales that were not from the preferred area on the fish. (Scales near the gills and tail are different in shape from the preferred scales and are difficult to read and identify to species. Preferred scales come from the area a few rows above the lateral line and below the posterior insertion of the dorsal fin. Scales to be used for stock identification are taken from this area.) We all agreed on the species and age assigned to each of the other scales.

Scale experts at the Fisheries Research Institute, University of Washington, agreed with my identification of chum and sockeye salmon from the scales and verified my opinion that the low number of "preferred scales" and the possibility of more than one scale coming from a single fish made continent-of-origin estimates from scale characters meaningless. They also suggested that two of the scales that I listed as unidentified may have been from pink salmon (O. gorbuscha).

DISCUSSION AND CONCLUSIONS

There were 106 scales mounted that were not identified to species (Table 1), although most were probably chum and sockeye salmon scales and a few were likely from pink salmon. Their shape indicated that they were probably from areas far from the

preferred area; I chose to not try to identify them. Therefore, the estimate of salmon present in the samples is conservative.

On most of the scales, an annulus was partially formed on the edge of the scale. In chum, the annulus forms in the late winter or early spring; therefore, the majority of the scales represent fish caught during that time.

In samples taken from scrapings, it is possible that many scales could have come from a few fish. However, the fact that there are many different age groups represented, rules out the probability that all the scales came from a few individuals. Using information from Helle (1979), I determined that because of different growth patterns, scales from the same year group represented many different individuals.

Sixty-one percent of the chum salmon scales had three marine annuli. These fish would be 4-yr-olds if they had survived this summer. Four-yr-old chum salmon are common in spawning stocks throughout their range. Spawning chum salmon stocks in the southern portion of their range on both sides of the Pacific Ocean can be made up of 50% or more 3-yr-old fish. Three-yr-old chum salmon are less numerous in the northern portion of their range (Marr 1943; Sano 1966).

The large percentage (58%) of sockeye scales with two freshwater annuli is indicative that they came from northern stocks. Older smolts generally are associated with more northern stocks (i.e., from northern Southeast Alaska northward and westward on the North American side of the Pacific Ocean)

that spend 2 years or more in fresh water and are common in the Kamchatka area of the USSR (Hanamura, 1967).

The large percentage (61%) of sockeye scales with three marine annuli is also indicative of sockeye from more northern areas (Mosher, 1963). The age of these fish (74% were 5- and 6-yr-olds) indicates that they are from northern areas and that they are from large fish.

Most of the scales from both the chum and the sockeye represent large salmon that would probably be mature by spring and spawn in the same year (Table 1).

Estimates could be made from the sockeye scales as to continent of origin; however, of the scales that are collected from scrapings, few would be from the preferred area on the fish. Also, many scales may be from the same fish. Scales could be picked out that resemble preferred area scales, but that would be time-consuming and the resulting data may not be reliable enough to justify the cost.

The growth in the first year at sea of the chum salmon scales makes it unlikely that they are from North America south of the Alaska Peninsula. Chum salmon from these areas usually have about twice the number of circuli present in the first year zone than what the scales from the Taiwanese vessel had.

If most of the fish represented by the scale samples were captured in the area where the vessel was first sighted with its gear in the water, it is likely that most of the fish would

be of Asian origin. Where the fish represented by our scale samples were caught is not known.

I conclude, based on the scale samples I analyzed, that 1) most of the fish aboard the Cyi Yang No. 1 were salmon (chum and sockeye), 2) most of the fish were large and nearly mature, 3) most of the fish were captured in the winter or early spring, 4) most of the chum were not from areas in North America south of the Alaskan Peninsula, and 5) most of the sockeye were from northern latitude areas.

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Glen Oliver, Scott McPherson, and Ben Van Alen, fishery biologists with the Alaska Department of Fish and Game, verified my interpretations of a sample of the scales.

Katherine Meyers and Robert Walker, fishery biologists with the Fisheries Research Institute, University of Washington, Seattle, made an independent interpretation of about one-half the scales.

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