

Fig. 2. Relationship between dietary phosphorus levels and the growth rate and the ash content of the bones in chum salmon.

○—○, Growth rate; ●—●, Ash content of the bones.

calcium levels. The fish on the diet without phosphorus supplement revealed deformity of the bones as the most noticeable gross external sign (Fig. 3) at the 6th week of the feeding and the abnormality of the bones attained 55% at the end of the experiment. As compared with those fed diets of adequate phosphorus levels, all of the fish showed insufficient growth of bones and had pale viscera (Fig. 4). Abnormal calcification was also observed in carp and rainbow trout fed diets low in available phosphorus.<sup>5,6,10</sup> Those abnormalities recognized in the bones were confirmed by the changes in the mineral composition of the bones.

3. Mineral composition The effects of dietary levels of phosphorus on the mineral compositions of the bones and whole bodies of chum salmon are summarized in Tables 4 and 5. Dietary phosphorus levels affected greatly the ash, calcium and phosphorus contents both of the bones and whole bodies. In the groups fed low phosphorus diets

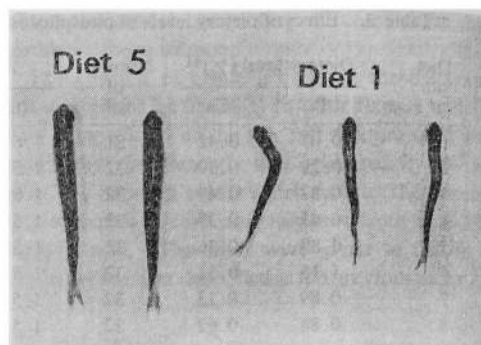


Fig. 3. Photograph showing the deformity of the bones in the fish fed the phosphorus-deficient diet (diet 1).

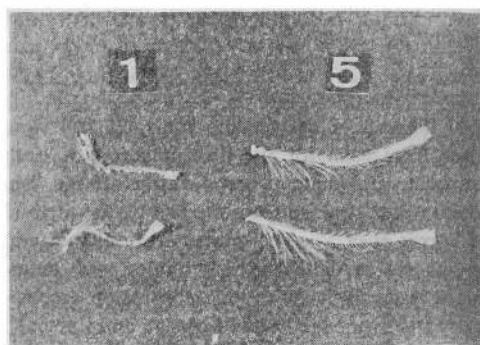


Fig. 4. Photograph showing insufficient mineralization of the bones from the fish fed the phosphorus-deficient diet (diet 1).

these mineral components, not only phosphorus but also calcium, decreased markedly regardless of the calcium contents in the diets. These results may indicate that to utilize these elements chum salmon have an ability to balance the Ca/P ratio of the bodies by controlling the absorption or excretion of calcium. This was indicated in carp and rainbow trout by OGINO *et al.*<sup>5,6</sup>

Table 4. Effects of dietary levels of phosphorus on the mineral compositions of the bones of chum salmon in Experiment I (Lipid-free dry basis) (%)

Diet No.	Dietary P (%)	Ash	Ca	P	Ca/P	Mg	Na	K
1	0.07	16.4	4.4	3.3	1.3	0.2	0.1	0.6
2	0.29	21.6	6.4	4.4	1.5	0.2	0.2	0.6
3	0.27	19.2	5.6	4.0	1.4	0.2	0.2	0.6
4	0.45	36.0	11.6	6.7	1.7	0.3	0.1	0.2
5	0.89	38.8	13.1	7.8	1.7	0.3	0.1	0.1
6	1.15	39.4	12.9	7.8	1.7	0.3	0.1	0.3
7	0.89	38.7	12.3	7.6	1.6	0.3	0.1	0.3
8	0.84	41.6	12.3	7.8	1.6	0.3	0.2	0.5





