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研究課題名(和文) A Socio-Ecological Approach to Restoring River Connectivity and Rewilding Salmon as Keystone Species in the Kushiro River Watershed, Eastern Hokkaido, Japan

研究課題名(英文) A Socio-Ecological Approach to Restoring River Connectivity and Rewilding Salmon as Keystone Species in the Kushiro River Watershed, Eastern Hokkaido, Japan

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研究成果の概要(和文)：河川流域は、人間と非人間の生活を維持するために不可欠な天然資源を提供するだけでなく、洪水による壊滅的な被害も引き起こす。しかし、歴史的および現代の河川資源の所有をめぐるせめぎ合いは、国家による領土管理と河川資源の乱開発を促進する特定の河川統治の形成につながった。本研究では、河川流域をcommonsとして理解する可能性を探り、人間と非人間の多様な主体、それらの重なり合う利害、そしてそれらの多様な時間的および空間的感覚を、政策議論が河川流域のガバナンスにどのように統合できるかを検討した。

研究成果の学術的意義や社会的意義

Our research shows that shifting social-ecological relations over the last 150 years have shaped and been shaped by the state's efforts to territorialize river watersheds, categorize them, and commodify their resources.

研究成果の概要(英文)：River watersheds have not only provided essential natural resources for the sustenance of human and nonhuman lives but also caused devastating damage through floods. Yet, historical and contemporary claims over river resources led to the formation of particular river governance that facilitated the state's territorial control and overexploitation of river resources. Our research explored the possibility of conceptualizing river watersheds as a commons, and examined how policy discussions can integrate into river watershed governance the multiplicity human and nonhuman actors, their overlapping interests, and their divergent temporal and spatial senses.

研究分野：Environmental Studies

キーワード：Ecology and Society Salmon Fisheries Environmental governance Hokkaido Japan

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1 . 研究開始当初の背景

This research emerged from our inability to comprehend a knowledge gap between the official scheme of resource governance and other everyday practices of resources use in river watersheds in Japan. It goes without saying that all these official schemes and everyday practices of resource uses are effective in some areas while ineffective in others. Yet, the discussions of rulemaking as to how river resources should be managed completely lack of temporal and spatial perspectives of nature-society interactions. More generally, environmental problems suffer from fragmentation of academic disciplines, multiple regulatory regimes, and bureaucratic compartmentalization. Researchers lack a unified framework that allows to identify a common set of variables for organizing studies; thus ecological disciplines use different concepts and languages to describe and explain complex social-ecological systems. We thus set out to understand how various institutional arrangements of resources use have been destroyed, created, and contested in river watersheds in Hokkaido from a temporal and spatial perspective of nature-society interactions.

2 . 研究の目的

Our research elucidates social-ecological complexity and connectivity by studying salmon and oyster ecology and human activities as an integrated system. In our analysis, we rely on salmon and oysters that have experienced periodic depletions from overfishing in modern history as a lens through which we examined the complex and interdependent relationship between human and nonhuman worlds. Furthermore, our research investigates an on-going experiment to respond to uncertainties concerning salmon and oyster ecology, biodiversity and habitat loss, and fishery in Kushiro Bay and Akkeshi Bay. These uncertainties were analyzed through the framework of spatial and temporal scales. Through the evaluation of uncertainties and conflicts of interests, we attempted to arrive at a general consensus among stakeholders concerning assessment method, project scope, objectives, and goals.

3 . 研究の方法

By employing social-ecological systems analysis, we explored how ecology-centered approaches can inspire sustainable watershed governance. We relied on archival photographs and maps, national river surveys and government records on river conditions over time (water levels, water flow rate), documentation from civil engineering projects, archival materials from agricultural, forestry, and fishery associations, official municipal histories. In so doing, we mapped out the complexity and connectivity of conflicts of interests between salmon and human not in terms of the dichotomy between nature and society but in terms of the temporal and spatial scales for a better policy integration.

4 . 研究成果

Building on previous studies, our research has contributed to understanding resources governance in Hokkaido. Our research findings can be summarized as follows. First, From the 1600s to the early 1900s, the Kushiro River was remodeled to support the territorialization efforts of the modern state. Regarded as inalienable by the Ainu and embedded in their cultural practices and kinship ties, the river gave them the means to extract resources and trade with *Wajin* merchants. Yet trade and its related institutions were still heavily influenced by the local watershed ecology and seasonal cycles. The political geography of the trade was one of loose control, with Ainu chieftains claiming use and access of the river and acting as intermediaries between the merchants and the Ainu communities. Yet Edo, driven by its dependency on the area's animal resources such as salmon and concerned about the threat of foreign powers in the north, sent Matsudaira to investigate. When the Imperial Japan came into power in 1868, it marked a pivotal moment in the history of Hokkaido. The modern state saw the region as a northern military stronghold and a storehouse of resources essential for empire-building such as sulfur, lumber, and horses. To achieve its territorial aspirations, the state deployed colonial administrators to enhance Kushiro River's role as a transportation route, as steamboats navigated through a dredged and debris-free

river to carry goods and colonists to new settlements. This transformation of the river from a revered landform to water infrastructure enabled the state to exert its dominance over labor and natural resources in the region. The changes to the river environment mirrored the shift from a trade-focused territoriality to one characterized by cartographical legibility, settler colonialism, and modern civil engineering. When a new network of rails and roads began to function as the main trade route, Kushiro River's transformation as infrastructure for water and sediment delivery was complete.

Second, the migratory species salmon connect two types of ecological systems--freshwater and saltwater systems. Salmon runs play an important role in providing essential ecological services for sustaining rich forests and wetlands along their runs. Juvenile salmon eat terrestrial insects near riverbanks while adult salmon carry nutrients from ocean to rivers. Since the Meiji period, however, the problem of depleted salmon stocks has been addressed primarily by improving the efficiency of reproduction outside the natural reproductive environment. The reproduction of salmon has been facilitated by state planning. Yet, natural reproduction has been hindered by the development of salmon propagation; returning salmon today are caught by *urai* near the river mouth and artificially inseminated at hatcheries. In 1888, the Meiji government began salmon propagation in Chitose to increase fishery resources. State-led salmon propagation has not only transformed local salmon culture but also disconnected the important ecological link between the freshwater and saltwater systems. As a result, salmon has been separated from part of the intricate food web in the ecological system, composed of nutrients, planktons, insects, fish, and animals that move across the ocean, rivers, and forests. In Kushiro and Akkeshi, wetland conservation efforts and the promotion of natural salmon reproduction can be mutually beneficial, because the stakeholders all have something to gain. Reviving natural salmon runs may potentially improve the wetland ecosystem health, thereby increasing its capacity to protect the residential areas from floods, ensuring biodiversity and survival of threatened species, and continuing to draw tourists and outdoor enthusiasts.

Third, since the Meiji period, oyster stocks in Akkeshi Bay have experienced three major depletion: the collapse of natural oyster stock in the 1870s, the massive die-off of 1982-83, and the 2011 tsunami. The near annihilation of the natural oyster beds in Lake Akkeshi at the end of the 19th century was due to the introduction of new technologies, combined with the government's initial decision to privatize fisheries. The oyster die-off of 1982-83 was caused by the deterioration of the estuary environment, such as changes in temperature, increase in nutrients caused by deforestation in the watershed, and the accumulation of oyster waste. This event triggered a series of sweeping changes that incorporated a more sustainable aquaculture. However, local resistance to these changes resulted in an open disregard for the new rules. The tsunami caused by the East Japan Great Earthquake in 2011 reached Lake Akkeshi in the evening, washing away clam beds and oyster farms. Akkeshi's Industry Promotion Department and the Akkeshi Fishery Cooperative Association assessed the damage to be 1,033 ropes and 756 tons of oysters (nearly 80% of total oysters), at a total estimated sum of 1.76 billion yen. While the tsunami itself was an ecological disturbance, it compelled the FCA to enforce the use of the farms as a collective enterprise, rather than as individually owned facilities. This implementation of sustainable aquaculture, in turn, resulted in a healthier estuary. Thus we can view the post-tsunami recovery of both the social and ecological systems as an episode in a longer process of iterative learning, which led to the creation of the multi-level nested structures of aquaculture governance in Akkeshi.

5. 主な発表論文等

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〔図書〕 計0件

〔産業財産権〕

〔その他〕

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6. 研究組織

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7. 科研費を使用して開催した国際研究集会

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8 . 本研究に関連して実施した国際共同研究の実施状況

共同研究相手国	相手方研究機関
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