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Fishes of Empire: Imperialism and ichthyological introductions in British Malaya, 1923–42

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The cultural, technological, and socioeconomic dimensions of exotic animal introductions into the Malayan Peninsula have largely escaped the notice of scholars of British Malaya. At the same time, the scientific literature on exotic ichthyological introductions into Malaya has framed such introductions in largely biological terms. Biological factors alone, however, cannot explain the introduction and cultivation of exotic (sometimes temperate) fishes in tropical Malayan waters. Between 1923 and 1942, the Fisheries Department of the Straits Settlements and Federated Malay States experimented with introducing three categories of exotic fishes into the Malayan Peninsula. These fishes—the sepat siam*, Chinese carp and English trout—were reared and released into demographic and geographical landscapes profoundly shaped by imperial power. These animals were thus 'fishes of Empire', their introduction and cultivation in the Malayan Peninsula significantly influenced by the scientific, socioeconomic, technological, and cultural contexts of the British Empire. Studying the places, peoples, and technologies that shaped (and were in turn shaped by) these fishes of Empire offers insights into the intersections of imperial power, colonial science, and environmental history.*

In the early hours of Saturday, 18 April 1935, the S.S. *Antenor* slipped into the waters off Penang Island, after a long transoceanic journey that had started in Liverpool, Britain. In its cavernous holds, the ship carried 22,000 live rainbow trout (*Oncorhynchus mykiss*) ova, packed between layers of soft green moss.[1] The eggs had been obtained from the Bristol Waterworks Reservoir, loaded onto the *Antenor* at Liverpool, carried through Port Said and Colombo, before finally arriving in Penang about a month later. Once ashore, the piscine cargo was promptly despatched by overnight train; then, a specially outfitted lorry conveyed the fish ova up winding, newly opened mountain roads. At 9 a.m. the next day, after a journey

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1 George Robinson and David Waller, 'Tyne built ships: A history of Tyne shipbuilders and the ships they built', http://www.tynebuiltships.co.uk/A-Ships/antenor1925.html (last accessed 6 May 2022); Anon., 'Trout for the Cameron Highlands', *Straits Times* (*ST*), 13 Apr. 1935, p. 11; Björn Larsson, 'Blue Funnel Line', *Maritime Timetable Images*, http://www.timetableimages.com/maritime/images/bfl.htm (last accessed 15 Sept. 2021).

which had spanned oceans and continents, the rainbow trout ova arrived at their destination: a fish hatchery in the small town of Tanah Rata, on the slopes of the Cameron Highlands.[2]

These eggs were the first generation of rainbow trout to ever reach Malayan shores successfully. They had been specially procured by the Fisheries Department of the Straits Settlements and Federated Malay States (henceforth, the Department) as part of an experimental breeding programme to stock the Highlands' rivers for recreational fishing. Though the transoceanic transit was in itself a remarkable achievement, it constituted only one of the Department's many significant accomplishments in freshwater aquaculture during its 19-year tenure, until the outbreak of the Second World War halted any further experimentation. The efficient farming of freshwater fishes was a subject the colonial institution had studied since its inception in 1923, in efforts to improve the quality and quantity of local fish supplies. Although the Department also conducted experiments into cultivating other aquatic organisms (like oysters and sea turtles), and local freshwater fishes (such as *terbol* [*Osteochilus vittatus*] and *kalui* [*Osphronemus goramy*]), these studies were eventually discontinued in the face of inconsistent or inconclusive results.

This article focuses instead on the Department's efforts at raising three categories of 'exotic' freshwater fishes in Malayan waters: *sepat siam* (*Trichopodus pectoralis*), Chinese carp, and English trout.[3] These fishes were introduced into physical and demographic landscapes radically altered by British imperialism: the *sepat siam* into flooded rice padi-fields (created by the colonial Krian Irrigation Scheme); the Chinese carp into artificial fish ponds (dug by Chinese migrants); and, the English trout into hilltop rivers (which the British development of the Cameron Highlands had made accessible).[4] Of the three foreign fishes, only the *sepat siam* eventually succeeded in breeding independently in Malayan waters. For reasons which will be explained later, Chinese carp and English trout failed to establish themselves locally.

Attempts to introduce and acclimatise foreign organisms into local ecosystems constitute a distinct thread within the environmental history of the British Empire. Scholarship in exotic species introductions and historical ecology, however, has tended to focus on the settler colonies of Australia and New Zealand. In part, this skew is due to their relatively isolated ecosystems, and the comparatively recent instances of anthropogenic species introductions. These factors tend to render the consequences of species introductions more visible in the historical record, and thus relatively easier to study. The presence of acclimatisation societies in these colonies and their extensive experiments further established Britain's Australasian dominions as a centre for such scientific research. Scholars of South Africa and British India have similarly examined the consequences of species introductions in

2 Soong Min Kong, 'Introduction of trout into the Cameron Highlands streams', *Annual Report of the Fisheries Department* (*ARFD*) 1935 (Singapore: Government Printing Office [GPO], 1936), p. 516.

3 *Sepat siam* is also known by its scientific synonym *Trichogaster pectoralis*, and its common name, the snakeskin gourami. Whereas *sepat siam* is a species with specific scientific designations, 'Chinese carp' and 'English trout' were generic labels used by the Fisheries Department to refer to at least four species of carp and two distinct species of trout.

4 P.J. Drake, 'The economic development of British Malaya to 1914: An essay in historiography with some questions for historians', *Journal of Southeast Asian Studies* 10, 2 (1979): 262–90.

these localities, due to the acclimatisation societies and scientific institutions which also flourished there.[5]

Conspicuously lacking in this scholarship, however, are studies examining acclimatisation experiments in British Malaya, beyond a few key plant species. As Joanna Lee observes, environmental histories of Malaya have remained largely preoccupied with the study of cash crops, mining, and colonial forestry. Indeed, existing historical studies of the Malayan environment have mainly explored the development of lucrative commodities, particularly gutta percha, rubber, and tin. Recently, historians have also begun to examine the interactions between human communities and animals in the colonial period.[6]

Less clearly understood, however, are colonial efforts at adapting exotic animals (particularly freshwater fishes) to Malayan ecosystems for agricultural purposes. In part, this is because the few works which study colonial fisheries in British Malaya have tended to focus on the marine and economic aspects of the Fisheries Department's work.[7] This article posits that the Department's numerous pioneering experiments in the field of freshwater aquaculture and acclimatisation also merit further scrutiny, and are of historical significance. While these colonial experiments were not always successful, they represented new ways of researching and raising fish which had never been attempted before in Malaya.

When introducing these foreign fishes into Malayan ecosystems, the Department also took pains to win the support of local communities for very practical reasons. It is important to note that while the three fishes were 'exotic' in an ecological sense, they were culturally familiar to many of the migrant communities in Malaya by the early 1920s. Though it was the Department which eventually popularised the *sepat siam*'s cultivation across the rest of the Malayan Peninsula, rice farmers in the Krian district

5 Paul Star, 'Human agency and exotic birds in New Zealand', *Environment and History* 20, 2 (2014): 277; Pete Minard, *All things harmless, useful, and ornamental: Environmental transformation through species acclimatization, from colonial Australia to the world* (Chapel Hill: University of North Carolina Press, 2019); Jodi Frawley and Heather Goodall, 'Transforming saltbush: Science, mobility, and the remaking of intercolonial worlds', *Conservation and Society* 11, 2 (2013): 1–10; Brett M. Bennett, 'The El Dorado of forestry: The eucalyptus in India, South Africa, and Thailand, 1850–2000', *International Review of Social History* 55 (2010): 27–50; Ulrike Kirchberger and Brett M. Bennett, eds, *Environments of empire: Networks and agents of ecological change* (Chapel Hill: University of North Carolina Press, 2020); David M. Richardson, 'Introduction', in *Fifty years of invasion ecology: The legacy of Charles Elton*, ed. David M. Richardson (Hoboken: Wiley-Blackwell, 2011), pp. xiii–xix.

6 Joanna W.C. Lee, 'Trends and potential expansions in the environmental histories of British Malaya', *History Compass* 16 (2018), https://doi.org/10.1111/hic3.12446 (accessed 15 Sept. 2021); Daniel R. Headrick, 'Botany, chemistry, and tropical development', *Journal of World History* 7, 1 (1996): 1–20; S. Najundan, 'Economic development of Malaya', *India Quarterly* 8, 3 (1952): 289–311; Timothy P. Barnard, *Nature's colony: Empire, nation and environment in the Singapore Botanic Gardens* (Singapore: NUS Press, 2016); Timothy P. Barnard, *Imperial creatures: Humans and other animals in colonial Singapore, 1819–1942* (Singapore: NUS Press, 2019); Miles Alexander Powell, 'People in peril, environments at risk: Coolies, tigers, and colonial Singapore's ecology of poverty', *Environment and History* 22, 3 (2016): 455–82.

7 Raymond Firth, *Malay fishermen: Their peasant economy* (Oxon: Routledge, 1946); Hiroshi Shimizu, 'The Japanese fisheries based in Singapore, 1892–1945', *Journal of Southeast Asian Studies* 28, 2 (1997): 324–44; John G. Butcher, *The closing of the frontier: A history of the marine fisheries of Southeast Asia, c.1850–2000* (Singapore: Institute of Southeast Asian Studies, 2004), pp. 168–233; Choo Ruizhi, 'Making fish: Empire, experiments, and the Fisheries Department of British Malaya, 1923–1942' (MA thesis, National University of Singapore, 2019).

of Perak had already raised the fish for nearly three years before the Department commenced its investigations; by that time, it was already known as a dried or salted food 'in almost every sundry goods shop' in Perak. Similarly, Chinese carp was a prized food-fish amongst Chinese communities in Malaya even before colonial intervention, while trout angling was a traditional and much-loved English recreation. The Department's ichthyological introductions thus reflected relatively conversant understandings of local economic needs and cultural practices. Through prolonged, 'complex interactions with local intermediaries and indigenous expertise', colonial scientists in Malaya came to understand that their schemes would not succeed without the approval and assistance of local communities, and hence took considerable steps to secure such support.[8]

These encounters complicate postcolonial discourses that emphasise the cultural violence and environmental mismanagement of the British Empire. While such scholarship is important for highlighting the very real excesses of colonial power, they sometimes risk creating monolithic narratives of victimised local communities and capitalist aggressors. At the same time, these narratives may also deny the environmental agency of colonised peoples, as well as the possibility that local communities could have benefited from colonial policies.[9] This article nuances such discourses, by showing the complex dynamic between colonial subjects and colonial scientists, as the Fisheries Department introduced exotic fishes into Malaya's culturally variegated landscapes in ways that local communities would accept and support.

Finally, and most critically, this article responds to the few existing historical accounts of these exotic piscine introductions: written, published, and disseminated primarily in scientific fora.[10] These narratives, however, rely heavily on post-Second World War sources, and offer little indication of the pre-war colonial contexts that led to the introduction of these fishes. Consequently, these accounts have tended to overlook the historical, socioeconomic, and cultural aspects behind such ichthyological introductions. These shortcomings are likely due to the lack of data openly available to earlier researchers. For instance, though aware that trout had once been introduced into the rivers of the Cameron Highlands during the colonial period, Kok Jee Ang et al. lamented in 1989 that 'no details are available on the numbers [of

8 C.F. Green, *ARFD 1925* (Singapore: GPO, 1926), p. 403; Anon., 'Fisheries of Kedah', *Malaya Tribune* (*MT*), 25 Feb. 1927, p. 2; Soong Min Kong, 'Fishes of the Malayan padi-fields, *sepat siam* (*Trichogaster pectoralis*)', *Malayan Nature Journal* 3, 2 (1948): 87–90; Jacob Bull, 'Watery masculinities: Fly-fishing and the angling male in the south west of England', *Gender, Place and Culture* 16, 4 (2009): 445–65; Joseph M. Hodge, 'Science and empire: An overview of the historical scholarship', in *Science and empire: Knowledge and networks of science across the British Empire, 1800–1970*, ed. Brett M. Bennett and Joseph Morgan Hodge (New York: Palgrave Macmillan, 2011).

9 Claude Alvares, *Science, development and violence* (Delhi: Oxford University Press, 1991); Madhav Gadgil and Ramachandra Guha, *This fissured land: An ecological history of India* (Berkeley: University of California Press, 1993); James Beattie, 'Recent themes in the environmental history of the British Empire', *History Compass* 10, 2 (2012): 129–39; Hodge, 'Science and empire', p. 11.

10 Kok Jee Ang, R. Gopinath and T.E. Chua, 'The status of introduced fish species in Malaysia', in *Exotic aquatic organisms in Asia: Proceedings of the Workshop on Introduction of Exotic Aquatic Organisms in Asia*, ed. S.S. De Silva (Manila: Asian Fisheries Society, 1989), pp. 71–82; L.M. Chou, and T.J. Lam, 'Introduction of exotic aquatic species in Singapore', in De Silva, *Exotic aquatic organisms*, pp. 91–7; Ahyaudin bin Ali, 'Rice-fish farming development: Past, present and future', in *Rice-fish research and development in Asia*, ed. Catalino Dela Cruz (Manila: ICLARM, 1992), pp. 69–76.

trout] released'.[11] Using data now available from the Fisheries Department's annual reports, newspaper articles, and other contemporaneous sources, these investigations into historical ecology can now be revisited and better contextualised; and the numbers of trout released into the Cameron Highlands during the late colonial period ascertained.

This article hence offers two related arguments. First, that these animals studied, raised, and released by the Department were 'fishes of Empire'. Not only had the fishes been introduced by a colonial institution, Empire had also facilitated the development of conditions, communities, and landscapes necessary for the fishes to grow (and momentarily flourish). Any explanation of these ichthyological introductions is hence incomplete without first understanding that these alien fishes were brought into physical and demographic landscapes profoundly shaped by imperial power. Anthropogenic species introductions thus cannot be divorced from the material and historical contexts in which they occurred.[12]

Yet this imperial power was not monolithic nor totalising. It also relied on the sanction and support of local stakeholders. By examining the complex dynamics between colonial scientists and colonial subjects which arose as a result of the Department's ichthyological experiments, this article further argues that colonial science in British Malaya was actually a highly collaborative venture. This is, thus, a story about the fishes of Empire—and the peoples, places, and processes involved in their introduction into the socioeconomic and ecological landscapes of British Malaya.

Sepat Siam in the padi-fields

The Fisheries Department's earliest (and most successful) foray into freshwater aquaculture began in northern Malaya. In 1925, seeking to improve the quality and quantity of local fish supplies, the newly formed Department commenced investigations into a 'very oily fish' of significant economic potential that was being cultivated in Krian, a district in Perak near the Malayan–Siamese border.[13] The fish's Malay name, *sepat siam*, was a colloquial reference to its Siamese origins. Of course, this fish did not materialise overnight. By emplacing the *sepat siam*'s introduction within a specific historical, cultural, and ecological context, this section reiterates the main arguments here: the crucial role of British imperialism in the fish's introduction, and the complex dynamics that undergirded this power.

Krian, the first Malayan district into which the *sepat siam* was introduced, was itself a product of imperial power, its landscape drastically altered by decades of colonial irrigation works for rice cultivation. Imperial power thus created the conditions which would later enable the fish to thrive. Yet Krian did not seem to offer many

11 Ang et al., 'Introduced fish species in Malaysia', p. 76. In the same vein, Chou and Lam's account of Chinese carp introductions in Singapore's 'early history' specifies no primary source for its historical claim, while Ahyaudin's entire historical overview of *sepat siam* cultivation in Malaysia derives from just one 1948 source.

12 Dan Tamir, 'Motives for introducing species: Palestine's carp as a case study', *Environment and History* 16, 1 (2010): 73–95.

13 Prior to Dec. 1923, the fisheries of British Malaya were administered by a patchwork of organisations in the different Malay States and colonies. Subsequently, all the offices were centralised under the Fisheries Department of the Straits Settlements and Federated Malay States. W. Birtwistle, *ARFD 1932* (Singapore: GPO, 1933), p. 442.

economic prospects to British officials initially. The prominent colonial administrator Frank Swettenham once described the region as a 'roadless jungle with a few padi fields'. This sparsely settled, swampy wilderness eventually became the Perak district of Krian. In the late 1870s, after British intervention in the region, colonial officials gradually introduced drainage and communications infrastructure, and encouraged immigrant families to settle there.[14]

As part of these developments, colonial authorities oversaw the construction of the Krian Irrigation Scheme between 1899 and 1906. An extensive irrigation complex, the Scheme was constructed to expand the area available for settlement and regular rice cultivation. Despite having 'grossly exceeded' initial time and budget estimates, the scheme eventually irrigated 28,327 hectares of land for rice farming, and provided greater water security for rice cultivation.[15] The ambitious scale of the Krian irrigation works would not be surpassed until after 1932, with the establishment of a centralised Drainage and Irrigation Department. Imperial power and technologies made their mark on this landscape: previously unproductive swamps and rainforests had been drained, cleared, and transformed into productive rice land, which immigrants from Java and Sumatra subsequently cultivated.[16]

Sepat siam entered this imperially modified environment around 1921 through local commercial networks and rice farmers. The introduction of the fish, originally from Siam as its Malay name implies, was a 'great success', in part because it was a relatively uncomplicated animal to cultivate. As a tropical labyrinth fish capable of breathing air with a specialised organ, it can survive in waters with low oxygen content, in both acidic and hyper-alkaline conditions. Once released into flooded wet-rice (or padi) fields, the fish fed on algae in its juvenile phase before maturing into opportunistic omnivores. *Sepat siam* grew so rapidly that they could be harvested together with the padi later in the rice-growing season, about eight to ten months later. They would then often be sold to Chinese dealers, to be dried and salted. The fish were also highly fecund, producing a great number of eggs that were dispersed on 'a raft of bubbles' over flooded padi-fields.[17]

These hardy, adaptive qualities made the fish a favoured candidate for the Department's early aquaculture investigations, as the institution sought to boost domestic food production and lower fish prices. *Sepat siam*, however, remained largely unknown outside Krian, except as a salted or dried food in sundry goods shops. The Department subsequently launched a study to expand *sepat siam*

14 Frank Athelstane Swettenham, *About Perak* (Singapore: Straits Times Press, 1893), p. 42; D.E. Short and James C. Jackson, 'The origins of an irrigation policy in Malaya: A review of developments prior to the establishment of the drainage and irrigation department', *Journal of the Malaysian Branch of the Royal Asiatic Society* (*JMBRAS*) 44, 1 (1971): 78–103.

15 Original figure 70,000 acres.

16 Cheng Siok Hwa, 'The rice industry of Malaya: A historical survey', *JMBRAS* 42, 2 (1969): 130–44; Short and Jackson, 'Origins of an irrigation policy in Malaya', p. 94; Drake, 'Economic development of British Malaya', p. 276.

17 See further W. Birtwistle, *ARFD 1935* (Singapore: GPO, 1936), pp. 503–4; Jiamjit Boonsom, 'Pla salid (*Trichogaster pectoralis* Regan): A life history and manual for culture', *Aquaculture practices, planning and extension in Thailand*, http://www.fao.org/3/ac231e/AC231E12.htm (accessed 17 Dec. 2020); Soong, 'Fishes of the Malayan padi-fields', pp. 87–90; Green, *ARFD 1925*, p. 403; Low and Lim, 'Gouramies', p. 86; Gunn Chit Thye, 'Steps to save sepat siam from being wiped out', *ST*, 12 May 1969, p. 13; Anon., 'Fisheries of Kedah'.

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cultivation into the agricultural heartlands of Malaya, due to its potential to become an 'important source of income' for rice farmers in other parts of the Peninsula. Sustained efforts were made in other states to persuade rice farmers to cultivate the fish, again in a bid to improve and diversify local food production in these areas. In the districts of Negri Sembilan, for instance, illustrated public notices in Malay were put up to advocate the fish's cultivation.[18]

To facilitate the widespread introduction of *sepat siam*, the Fisheries Department leveraged on another crucial piece of imperial technology: the railway car. Trials were conducted into transporting the fish overland by rail. With a few modifications, kerosene tins half-filled with water proved sufficient to allow 15 fish per tin to 'travel well' over long distances. Lim Tse Siang has noted how the burgeoning railway system in British Malaya functioned as an instrument of imperial rule, facilitating the extension of British authority across the Peninsula. Here, we witness how imperial technology could also be deployed as an ecological vector of Empire: disseminating organisms, objects, and ideas—such as fishes and methods of cultivating them—to other parts of Malaya. Not surprisingly, these efforts were well-received by colonial officials in various districts within the Federated Malay States (FMS). The scheme received the 'hearty support' of Negri Sembilan's British Adviser, nearly 400 kilometres from Krian. Requests streamed in from various parts of the Peninsula; in 1925 alone, over 450 of the Department's modified tins (each containing 15 fish) were distributed. A further 352 tins were issued from the district in 1927 to various localities. Each tin of fish cost farmers $3.50, a princely sum arising from the cost of railway and lorry freight.[19]

Although British officials were enthusiastic about the Department's scheme, there was a more mixed reception to *sepat siam* from experienced, local farmers. In addition to concerns over transport costs, there was a fear that the foreign fish would attack and feed on more commonly farmed fishes such as *aruan* (*Channa striata*) and *keli* (*Clarias teysmannii*). This belief was later proven untrue, since *sepat siam*, though omnivorous, was primarily an algae feeder. Nevertheless, the unfamiliar, 'muddy-flavoured' taste of *sepat siam* appears to have been initially unpopular with domestic consumers. In 1927, the *Malaya Tribune* reported that it was 'not favoured for the table fresh by the Malay'. The fish seems to have received a better reception with Chinese communities, who were the primary consumers of the fish in its dried and salted form.[20] Taken together, there is a sense that local consumers and cultivators alike had an ambivalent relationship with this alien fish, no matter how enthusiastic colonial officers might have been about its prospects. Perceptions in the state of Pahang, for instance, were mixed. In 1929, the District Officer at Bentong, Pahang,

18 Birtwistle, *ARFD 1935*, p. 503; Anon., 'Fisheries of Kedah', p. 2; Anon., 'Negri Sembilan', *MT*, 25 June 1926, p. 9.

19 To contextualise this 'princely sum', daily wages for agricultural workers in 1927 averaged about 60 cents a day. *Colony of the Straits Settlements Blue Book 1927* (Singapore: GPO, 1928), p. 504; Green, *ARFD 1925*, p. 404; Lim Tse Siang, 'The imperial locomotive: A study of the railway system in British Malaya 1885–1942', in *Studies in Malaysian and Singapore History*, ed. Bruce M. Lockhart and Lim Tse Siang (Kuala Lumpur: MBRAS, 2010), pp. 15–26; Anon., 'Fish culture', *MT*, 9 July 1927, p. 12; C.F. Green, *ARFD 1927* (Singapore: GPO, 1928), p. 126.

20 Anon., 'Fishing industry in Malaya', *ST*, 17 May 1929, p. 17; Anon., 'Fishes of the Malayan padi-fields', *ST*, 5 Aug. 1948, p. 8; Anon., 'Fisheries of Kedah', p. 2; Anon., 'In the padi swamps', *ST*, 13 Jul 1939, p. 10.

where colonial authorities had distributed six tins of the fish a year earlier, found it 'impossible to arouse the interest of the cultivators'. A similar, pointed indifference was likewise reported in the district of Kuala Lipis. In the districts of Raub and Temerloh, conversely, there were 'good results' and 'a large measure of success', although floods later in the year washed the fish away.[21]

Orders from farmers for *sepat siam* to stock their padi-fields cooled over time; this decline, however, was received favourably. To colonial officials, it was a sign that 'the original stocking has been successful', as the fish reproduced prolifically, rather than as an indication of rejection by local communities. In 1929, the Department recorded that total demand for the fish had dropped to only six tins; by 1930, this figure had fallen to zero. William Birtwistle, the Department's Director, reported that 'all areas capable of carrying stocks have become fully supplied', and that *sepat siam* was 'firmly established as a marketable product'.[22]

Birtwistle's conclusion was supported by anecdotal evidence in the early 1930s suggesting that *sepat siam* output had grown to 'a very large figure'.[23] In 1933, fishery officers obtained data from several Chinese middlemen that allowed an insight into the industry's burgeoning scale. Nineteen Chinese dealers in the Krian *mukims* of Kuala Kurau, Tanjong Piandang, Sungei Bakau, and Simpang Ampat sold 390 tonnes of dried *sepat siam* to Singapore and Penang markets.[24] The live, or 'wet' weight of the fish traded from these dealers was worth a staggering $40,000. In 1935, Krian dealers alone sold 538.5 tonnes of dried and salted *sepat siam*, with an estimated value of $54,500.[25] By 1939, this figure had more than doubled to 1,219 tonnes of the fish, valued at $150,000.[26]

Although it appears to have been unpopular amongst local Malay communities, *sepat siam* found favour with Malayan Chinese communities instead. All recorded *sepat siam* dealers were Chinese, and the main markets of this fishery were Penang and Singapore, with their sizable migrant Chinese populations. Chinese fish dealers were also purchasing these fish for regional export. While the Department had not introduced *sepat siam* with the goal of making it an export product, surplus output was so great that by 1939, resourceful businessmen were shipping the fish in dried and salted forms to markets in Sumatra.[27] It is instructive to note that no other species of freshwater fish farmed in British Malaya during this period was traded in such spectacular volumes. For instance, the total haul in 1938 of the commonly farmed *aruan* fish yielded no more than 48.4 tonnes, a miniscule fraction compared to the 1,119.2 tonnes of *sepat siam* landed that year.[28] Soong Min Kong, a fisheries expert

21 Smedley, *ARFD 1929*, p. 56.
22 Birtwistle, *ARFD 1932*, p. 442; Smedley, *ARFD 1929*, p. 56; Anon., 'Fish a national asset', *MT*, 1 Aug. 1931, p. 3.
23 Comprehensive statistics regarding annual *sepat siam* production were unavailable at this time. W. Birtwistle, *ARFD 1931* (Singapore: GPO, 1932), p. 881.
24 In the FMS, *mukims* functioned as administrative subdivisions of a district. Original figure 650,000 katties for 1933. W. Birtwistle, *ARFD 1933* (Singapore: GPO, 1934), pp. 566–71.
25 Original figure 530 imperial tons. Birtwistle, *ARFD 1935*, p. 503.
26 Original figure 1,200 imperial tons. Anon., 'Fishes of the Malayan padi-fields', p. 8.
27 Gunn, 'Steps to save sepat siam', p. 13.
28 Original figures 80,798 katties and 1,865,310 katties, respectively. W. Birtwistle, *ARFD 1938* (Singapore: GPO, 1939), pp. 490–91.

in post-war Malaya, later corroborated this extraordinary disparity, observing that even the 'combined economic importance' of other cultivated freshwater fishes 'falls far short of that of Sepat Siam'.[29]

In the absence of comparative historical baseline statistics, it is unclear why the *sepat siam* fishery grew so meteorically compared to other freshwater food-fish.[30] Nonetheless, several possible explanations present themselves. Biologically, Soong has posited that the *sepat siam*'s undemanding, largely herbivorous diet, in contrast to the carnivorous (and hence costlier) diets of fishes like *aruan* or *keli*, made it an easier, more profitable fish to raise. From a broader institutional perspective, the Department's sustained, systematic efforts to encourage *sepat siam* cultivation also played a crucial role in the eventual size of this fishery. No other freshwater fish was introduced so methodically through British Malaya's expanding railway networks. The fact that Kedah—a Malay state over 200 kilometres from Krian—produced 798.4 tonnes of *sepat siam* in 1938 (representing 71 per cent of that year's yield) attests to the significant role railways played in introducing and distributing the *sepat siam* across the Peninsula.[31] The Department's decision to capitalise on the growing railway networks of British Malaya exposed new, faraway communities to the cultivation and consumption of this alien fish.

Owing in part to the Department's efforts, *sepat siam* became 'widely distributed in swamps, rice fields, and irrigation canals throughout the country' in subsequent decades. Economically, Krian, the initial Malayan centre for *sepat siam* cultivation, would remain an 'important source of freshwater fish' in postcolonial Malaya, with the harvested fish exported to Singapore, Indonesia, and Thailand in dried or salted forms. Ecologically, the *sepat siam* had thus largely established itself in Malayan waterways by 1939, having successfully produced sizable, self-sustaining populations in different parts of Malaya. Its resilient and fecund qualities had enabled it to thrive in new ecological niches created by human activity.[32]

The flourishing of this fish in many diverse localities across the Malay Peninsula, however, went beyond biological factors. Imperial power also played a critical role. This point is manifested in altered physical landscapes and shifting demographics, as well as the establishment of institutions and technologies that created the conditions favourable for the spread and success of the *sepat siam*. While the colonial Department's research had sparked efforts to encourage the fish's cultivation in rice-growing communities, new transport infrastructure had also served as an effective vector for ecological and aquacultural introduction. At a deeper level, imperial technologies, such as the Krian Irrigation Scheme, had also facilitated the creation of new physical and cultural landscapes in Malaya.

Imperial power, however, was not absolute, nor infallible. This ichthyological introduction was also contingent on the approval of local communities. Where this was not forthcoming, such as in Kuala Lipis and Bentong, *sepat siam* was not

29 Quoted in Anon., 'Fishes of the Malayan padi-fields', p. 8.
30 The Fisheries Department only began collecting detailed catch figures in 1931. Birtwistle, *ARFD 1931,* p. 883.
31 Anon., 'Fishes of the Malayan padi-fields', p. 8; Original figure 1,330,734 katties. Birtwistle, *ARFD 1938*, p. 494.
32 Low and Lim, 'Gouramies', p. 89.

cultivated. Conversely, it was the booming demand for the fish from immigrant Chinese markets in Penang and Singapore, which further encouraged its continued cultivation and distribution. While it is unclear how significantly *sepat siam* ultimately altered culinary traditions throughout Malaya, the fish continued to be consumed widely by Chinese communities in dried and salted forms throughout Malaya well into the 1960s.[33] Finally, it is important to remember that the very Chinese communities which had fuelled the *sepat siam*'s boom were themselves an indirect product of Empire, attracted to work and settle in Malaya as a result of liberal colonial immigration policies and rosy economic prospects. These sizable Chinese communities in turn precipitated the introduction and cultivation of another fish of Empire into Malaya: the Chinese carp.

Chinese carp in fish ponds

Imperial power shaped the places and peoples favourable for the meteoric expansion of *sepat siam* cultivation in Malaya. Colonial knowledge and influence had, over decades, not only created spaces in which the fish were reared, but also markets in which it was enthusiastically consumed. The widespread distribution of Chinese carp by colonial institutions followed a similar pattern. Introduced to imperially modified Malayan landscapes by Chinese immigrants, the Fisheries Department later expanded the cultivation of Chinese carp in Malaya and Singapore. As in the case of *sepat siam*, this expansion was also greatly dependent on the response of local communities. As part of efforts to improve the quality and quantity of fish supplies in Malaya, the Department started researching Chinese carp culture in Singapore at about the same time it began investigating *sepat siam* in Krian.[34]

'Chinese carp' was the Department's generic designation for at least four different species of fishes that Chinese breeders introduced into Malaya in the early twentieth century. These fishes: the mud carp (*Cirrhina molitorella)*, big-head carp (*Aristichthys nobilis*), grass carp (*Ctenopharyngodan idellus*) and silver carp (*Hypophthalmichthys molitrix*), also had separate Hokkien, Cantonese and Teochew dialect names, reflecting the regional diversity of the cultivators who reared them. 'Chinese carp' here will hence refer to all four carp species the Department investigated, which were incapable of reproducing in Malayan waters, and had to be continuously imported from China.[35]

In addition to being important cultural symbols, carp have been highly prized food-fishes in Chinese communities for centuries. For breeders with the requisite expertise, the cultivation of such fishes was a lucrative venture, their market value in Malaya being equivalent to that of 'first class sea-fish'.[36] Being temperate fishes, however, Chinese carp could not breed in tropical waters. Instead, cultivators regularly shipped live carp stocks from Canton to Singapore in the form of fish fry. Carp eggs were first collected from rivers in the Pearl River region using set-bag nets, then hatched and transported in enormous tubs (each capable of holding about 30,000 carp fry) aboard vessels bound for British Malaya. When the ships called

33 Gunn, 'Steps to save *sepat siam* from being wiped out', p. 13; Anon., 'In the padi swamps', p. 10.
34 Green, *ARFD 1925,* pp. 404–5.
35 D.W. Le Mare, *ARFD 1949* (Singapore: GPO, 1950), pp. 130–31; Green, *ARFD 1925*, p. 405.
36 Ibid., p. 405.

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at Singapore after a 3,200-kilometre journey, the fry were subsequently transferred to smaller, flat-bottomed lighters, conveyed further up the Singapore River, before being transferred further inland on motor lorries to the nurseries of fish cultivators.[37] These pisciculturists then nurtured the young fish in shallow ponds until they grew to a marketable size. As a key trading destination for ships from southern China, Singapore acted as a node through which these alien fishes were introduced into the rest of Malaya.

Like the *sepat siam*, the carp entered a demographic and physical landscape that imperial power had greatly transformed. The Chinese population in Singapore had soared to over 372,000 by 1925, from an estimated population of just 200 when the British first arrived in 1819. This rapid demographic expansion was due largely to British policies encouraging Chinese immigration to Malaya as a means to supply cheap, plentiful labour to the burgeoning local economy. In addition to numerous 'push' factors such as famines, natural catastrophes, and political instability in south China, migrants were also drawn to Singapore for the economic prospects it promised. The island's storied reputation as a prosperous British-administered port in which humble labourers could find gainful employment attracted thousands annually to its shores.[38] It was the presence of such a significant migrant Chinese community that would in turn fuel the energetic import and consumption of carp in Singapore.

Growing populations also changed the physical landscape. A hundred years of British settlement had dramatically altered Singapore's natural environment. Colonial mismanagement had transformed the island: most of its primary dipterocarp rainforests had been felled for firewood; the soil had been exhausted by decades of gambier and pepper planting; mangroves and freshwater swamps had been cleared and drained for agricultural production. It was into this largely denuded, defoliated landscape that inland fish ponds for Chinese carp were dug and populated to meet the local market demand.[39]

Once they had been transported to these fish ponds, carp fry subsisted on pond algae, which bloomed exuberantly on inexpensive regimes of pig-manure and night-soil. The fishes grew rapidly on this diet, and were typically large enough for sale to more specialised pisciculturists four months after arriving in Singapore. Although these methods disgusted colonial officials, the Fisheries Department nonetheless conducted studies to investigate Chinese carp culture, in a bid to expand the cultivation of the valuable food-fish for domestic consumption. These initial investigations, however, quickly reached an impasse due to a lack of precise data. Local Chinese pisciculturists protective of their trade secrets offered increasingly vague

37 Anon., 'Malaya's carp industry', *Singapore Free Press and Mercantile Advertiser* (*SFPMA*), 6 Jan. 1932, p. 12.

38 A.L. Hoops, 'Registration of births and deaths, Straits Settlements', *Annual departmental reports of the Straits Settlements for the year 1925* (Singapore: GPO, 1926), p. 217; Joyce Ee, 'Chinese migration to Singapore, 1896–1941', *Journal of Southeast Asian History* 2, 1 (1961): 33–51; Stan Neal, *Singapore, Chinese migration and the making of the British Empire, 1819–67* (Woodbridge: Boydell & Brewer, 2019), p. 17.

39 Tony O'Dempsey, 'Singapore's changing landscape since c.1800', in *Nature contained: Environmental histories of Singapore*, ed. Timothy P. Barnard (Singapore: NUS Press, 2014), p. 46; Green, *ARFD 1925*, p. 405.

answers to colonial inquiries. The finer details of Chinese carp culture, such as fish-feed compositions and disease treatments, were never divulged to the colonial institution.

The reluctance of Chinese breeders to share the arcane minutiae of carp cultivation paradoxically intensified colonial interest in the topic. Consequently, the Department undertook a radically different research direction, applying contemporary European scientific principles to a traditionally Chinese domain of knowledge. Efforts turned to studying the practice in finer scientific detail, with the aim of 'reducing the carp-farmers' system to scientific terms', and thus translating the cultural knowledge of Chinese carp culture into techniques and terminologies comprehensible to Western science. The Department established experimental stations in the Singaporean districts of Woodleigh and Toa Payoh to research small-scale carp culture at 'the lowest cost possible'. These initial colonial experiments, however, proved disastrous. After extensive delays at the Toa Payoh ponds to achieve the 'rich vegetable growth' needed to feed the carp, a consignment of 'a few thousand fingerlings … died within a few days of their introduction'.[40]

Two years later, in 1929, the Department revisited this research approach when officials began systematically analysing the chemical qualities of more successful carp ponds for the first time. They surmised that the 'critical factor' was water acidity: carp typically flourished in ponds with an alkaline to slightly acidic pH of about 9 to 6.5. By contrast, the water in the Toa Payoh ponds was highly acidic, with a pH of 5. Efforts were consequently made to improve the experimental ponds' chemical conditions, to make them more conducive for cultivation of this specific species. Cartloads of fresh cow-manure were added to the ponds, increasing water alkalinity to pH 8. Although 25 introduced carp fingerlings died after 11 days, a second experiment at the Woodleigh station proved more successful, when 50 juvenile carp 'thrived' until heavy monsoon rains washed more acidic soil into the water, and killed them.[41] Despite this setback, the code had been cracked. After several failed trials, and thousands of dead fishes, the Department had confirmed that water and soil acidity were crucial factors for growing Chinese carp locally. It was a breakthrough previously unknown to European science. For the first time in British Malaya, Chinese carp culture had been rendered into principles and practices familiar to colonial knowledge. Birtwistle, the Department's director, published these findings in the Malayan Department of Agriculture's journal, circulating the information into colonial scientific networks.[42] The way now stood open to improve and further expand the cultivation of this alien fish.

Efforts next turned to rationalising other aspects of carp culture, such as their diets. Carp fatten rapidly on algae, and the cheapest way to ensure this algal diet was to enrich them with pig-manure or night-soil. The practice, however, was described by a colonial commentator as being of 'such a disgusting nature … I have never felt any wish to taste [the carp]'.[43] To make the fishes more palatable to non-Chinese markets, Birtwistle initiated studies into an alternative carp diet of

40 Ibid., pp. 404–5; Green, *ARFD 1927*, p. 126.
41 Smedley, *ARFD 1929*, p. 55.
42 W. Birtwistle, 'Rearing of carp in ponds', *Malayan Agricultural Journal* 19, 8 (1931): 372–83; W. Birtwistle, 'Transport of carp fry from China', *Malayan Agricultural Journal* 19, 10 (1931): 490–93.
43 C.N. Maxwell, *Malayan fishes* (Singapore: Methodist Printing House, 1921), p. 197.

elephant and guinea grasses in 1932. The fast-growing plants were cultivated on plots near carp ponds, providing an inexpensive, readily available (and colonially acceptable) food source for the fishes. Experiments into treating ponds with superphosphate fertiliser, a method borrowed from German pisciculturists, also yielded significantly faster-growing fishes.[44]

The experimentation with such hybrid innovations was fruitful. By the end of 1932, the Department had succeeded in raising Chinese carp without human or porcine fertiliser. A respectable 150 kilograms of carp, fed on a grass diet, could be raised from a single pond, then sold for a significant sum of $45.[45] This aquacultural breakthrough had cultural and economic implications for the Chinese carp industry in Malaya, as it opened cultivation to local Muslim (usually Malay) breeders and consumers, who had been precluded from raising the fishes due to religious prohibitions arising from the use of pig-manure. The use of grass diets now rendered the fish halal, making it available to a greater segment of the Malayan population.[46] Trial consignments of Chinese carp were subsequently issued by the Department to Malay fish farmers in the Kemaman and Kuala Lipis districts. After 'excessive losses' initially, the fishes at both locations started 'doing quite well'. In 1933, cultivation efforts were expanded with 'considerable success' to Pahang, as Malay breeders witnessed the profitability and ease of growing Chinese carp with the Department's modified methods.[47] This interest in Chinese carp cultivation grew swiftly; in 1934, Malay pisciculturists in Kelantan and Pahang received consignments totalling nearly 4,000 carp fry from the Department. By 1939, thanks in part to the favourable local response, the Chinese carp had established itself in Malaya as an 'excellent and cheap' food.[48] The Department's efforts had also effectively broken the Chinese monopoly on carp cultivation, an accomplishment that likely did not endear the institution to Chinese pisciculturists. The expanded introduction and distribution of Chinese carp therefore also had differing economic implications for different stakeholders in Malaya.

In an attempt to further reduce reliance on Chinese dealers, and again to 'ensure a plentiful supply of cheap fish' in Malaya, efforts were made in 1939 to breed a self-sustaining, local population of Chinese carp. The upper reaches of the Perak River, which appeared to possess similar hydrological conditions to the carp's native South Chinese rivers, were selected for this breeding project. This experiment was ultimately unsuccessful. High tropical water temperatures likely acted as an effective filter, inhibiting the carp's ability to reproduce. For this reason, Chinese carp were never able to establish themselves in Malaya.[49]

44 Birtwistle, *ARFD 1932*, p. 441; W. Birtwistle, *ARFD 1933* (Singapore: GPO), p. 565.
45 Original figure 250 katties. Birtwistle, *ARFD 1932*, p. 441.
46 Paul Kratoska, 'Rice cultivation and ethnic division of labour in British Malaya', *Comparative Studies in Society and History* 24, 2 (1982): 280–314.
47 Chinese carp fetched a considerable sum of 25 cents per kati. For comparison, fresh marine *kembong* fish in 1937 retailed at only 6 cents per kati. Birtwistle, *ARFD 1933*, p. 566; W. Birtwistle, *ARFD 1937* (Singapore: GPO), p. 572.
48 W. Birtwistle, *ARFD 1934* (Singapore: GPO), p. 1066; Anon., 'Chinese carp for Malayan rivers', *MT*, 31 Aug. 1939, p. 12.
49 Darren C.J. Yeo, Department of Biological Sciences, National University of Singapore, personal correspondence, 17 Feb. 2020; Anon., 'Malaya's carp industry', *SFPMA*, 6 Jan. 1932, p. 12; J.R. Britton, J. Cucherousset, G.D. Davies, M.J. Godard and G.H. Copp, 'Non-native fishes and climate change:

Although ultimately unsuccessful, these attempts demonstrated the Department's growing confidence with introducing alien fishes into Malayan waterscapes. At a broader level, the Department's serious, sustained (and briefly successful) efforts to expand Chinese carp cultivation throughout Malaya reflect again a pattern of imperial intervention. The introduction of Chinese carp to other Malayan communities had been facilitated by imperial processes that had radically altered the compositions of local landscapes and communities, a pattern also reflected in the case of *sepat siam*. The carp's expanded cultivation beyond the Chinese cultural sphere could moreover not have occurred without the Department's patient, pioneering work. Biological characteristics alone therefore cannot explain the local presence of Chinese carp, a category of temperate fish which required specific hydrological conditions to even survive in Malaya's tropical waterscapes. It was instead the confluence of favourable cultural, scientific, socioeconomic, and geographical conditions, engendered by British imperialism (and supported by different local communities), which had facilitated the brief florescence of these fishes of Empire.[50]

English trout in the Highlands

For many Europeans in British Malaya, colonial hill stations such as the Cameron Highlands offered a refuge from the heat and dust of tropical lowlands, where they could rest and recover 'amidst landscapes … evocative of Europe'. Recreational golf and trout fishing were some of the 'relaxing hobbies' available at these retreats, which largely catered to the sporting tastes of the British upper class.[51] It was within this colonial milieu of leisure and recreation that the Fisheries Department sought to create a trout fishery in the Cameron Highlands.

The experimental transfer and acclimatisation of foreign organisms to different parts of the world, often for economic profit, was an established colonial practice by the nineteenth century. As we have already seen, fish were not exempt from these efforts. In 1873, British ichthyologist Francis Day initiated aquaculture experiments to breed European fishes in Indian and Burmese waters. By the 1880s, the Australian Acclimatisation Society had successfully cultivated European trout that could survive in local rivers for recreational and aesthetic purposes. These piscine introductions were fundamentally linked to traditions of sportfishing in the Anglophone world. In the nineteenth century, these traditions were increasingly entangled with issues of class, gender, race, and national identity. For many in the English-speaking world, sportfishing came to signify the superiority of Western civilisation and white masculinity over other races.[52] The Department's efforts to raise

Predicting species responses to warming temperatures in a temperate region', *Freshwater Biology* 55 (2010): 1130–41.

50 Unlike the extensive literature on trout introductions, it is unclear from existing sources whether British scientists attempted to introduce Chinese carp to other colonies. British interest in Chinese carp in Malaya was likely opportunistic: capitalising on the existing localised, sophisticated infrastructure of carp cultivation and consumption among Chinese settlers in the colony.

51 Donald B. Freeman, 'Hill stations or horticulture? Conflicting imperial visions of the Cameron Highlands, Malaysia', *Journal of Historical Geography* 25, 1 (1999): 17–35.

52 Barnard, *Nature's colony*, p. 87; Francis Day, *Report on the fresh water fish and fisheries of India and Burma* (Calcutta: Government Press, 1873); Michael A. Osborne, 'Acclimatizing the world: A history of the paradigmatic colonial science', in *Nature and empire: Science and the colonial enterprise*, ed. Roy

and release trout into the Cameron Highlands were thus situated within these overlapping contexts of scientific acclimatisations, gendered fishing traditions, and civilisational discourses. These experiments were also arguably the Department's most sustained, systematic (though ultimately unsuccessful) effort at acclimatising and introducing exotic freshwater fishes into British Malaya.

Serious thought, time, and effort went into preparing the ground (and the waters) necessary for the introduction of English trout into Malayan rivers. The Department's efforts to acclimatise English trout (here defined as brown trout, *Salmo trutta*, and rainbow trout stocks originating from English reservoirs) coincided with broader colonial projects taking place in Malaya at the time. As early as 1925, when development of the Cameron Highlands was still in an exploratory phase—and about the same time investigations into *sepat siam* and Chinese carp were being initiated—potential trout introduction sites across the Peninsula were already being earmarked by the nascent Fisheries Department. Reflecting the growing British confidence in shaping Malayan landscapes to fit colonial imaginations, the Department contemplated stocking trout in an artificially dug lake on Fraser's Hill (a 'delightful hill station'). The lack of any suitably large streams (and budgets) eventually precluded such ambitious, idyllic visions. The Cameron Highlands, however, were retained as a 'promising field for trout culture'.[53] Read alongside the Department's concurrent efforts to improve local fish supplies (arguably a more critical undertaking), the extensive deliberations for a recreational fishery offer a striking reminder of the Department's colonial character, and its homesick British stakeholders.

Following a five-year delay in trout-culture research due to other, more pressing priorities in Malayan fisheries, the Department finally conducted preliminary tests into the water quality of nine streams in the Cameron Highlands in 1930. Promisingly, the tests found levels of dissolved oxygen, water temperature, and water acidity to be conducive for raising trout. Water temperatures in Highland streams, for instance, were found to range from 17.8 °C to 24.4 °C, at the edge of the 8.3 °C–21.1 °C temperature range in which imported trout in Ceylon had thrived and reproduced.[54]

On the strength of these results, the Department proceeded to shortlist appropriate species of trout to stock the Highlands. To do so, officials drew on inter- and intra-imperial networks of ichthyological expertise from across the world: from the Ceylon Fishing Club's experience with raising trout at the Nuwara Eliya hill station, to experts from the United States Bureau of Fisheries, who were familiar with introducing trout to new environments. The Department also contacted the Madras Director of Fisheries to ascertain the optimal breeding conditions for introduced rainbow trout in the Nilghiris River in Tamil Nadu. After meticulous consultation and research, the Department selected the brown trout and rainbow trout as the most viable candidates for stocking Highland streams. Rainbow trout ova from the Bristol Waterworks Reservoir were obtained to stock the Highlands. Although rainbow trout are native only to North America and East Asia, the fish which the

Macleod, *Osiris*, S2, 15 (2000): 135–54; Jen Corrinne Brown, *Trout culture: How fly fishing forever changed the Rocky Mountain West* (Seattle: University of Washington Press, 2015).

53 Green, *ARFD 1925*, p. 406.

54 Birtwistle, *ARFD 1931*, p. 881; W. Birtwistle, *ARFD 1930* (Singapore: GPO), p. 315.

Department's Director William Birtwistle selected came from lineages that had been successfully introduced and acclimatised to the British lake several generations before.[55] Imperial ichthyology, manifest in the knowledge networks, trans-imperial connections, and supply chains of the period, thus also determined the specific pathways and processes that brought particular stocks of acclimatised trout to Malaya.

After nearly five years of research spanning the globe, 22,000 rainbow trout ova from England arrived in Malaya on 18 April 1935, aboard the S.S. *Antenor*. Upon delivery to the Highlands, Department staff fastidiously tended to the eggs until they matured into free-swimming fry. Only 5,040 of the original 22,000 eggs survived to a length of approximately 7 centimetres, a 'fairly heavy' mortality rate. Although more succumbed later to an outbreak of fin-rot in December, the Department eventually released 4,418 trout fingerlings into the Cameron Highlands' streams. Various details of such releases, such as the date, locality of release, size and number of fish released, were carefully recorded.[56] The entire project, even with its staggering mortality rate, provided crucial data for the Department's future breeding projects. Moreover, the cost of importing rainbow trout ova from England was found to be so low that large stocks could theoretically be maintained simply by importing ova from England annually. With these calculations in mind, Birtwistle cautiously pronounced the inaugural rainbow trout experiment 'surprisingly successful'.[57]

Following this modest achievement, the Department procured additional batches of trout ova. Taking reference from the experiences of Nuwara Eliya, the Department also included 10,000 brown trout in its second consignment of 20,000 fish ova from the Bristol Reservoir. This time, about 80 per cent of the brown trout ova and 40 per cent of the rainbow trout ova survived the crossing. An additional shipment of 10,000 rainbow trout ova was procured, although only 2,000 fish from this batch survived the voyage. In sum, about 10,000 of the 30,000 trout imported in 1936 survived, eventually growing to a length of 10 to 15 centimetres.[58] The Department released 7,700 of these fishes into four Highland rivers: the Ichat, Terla, Telom and Kial, to 'reinforce' the earlier, pioneer generation of rainbow trout. In 1938, the Department successfully reared more than 8,000 healthy fingerlings from a batch of 20,000 brown trout ova, a success rate of 40 per cent. From the numbers of fishes successfully bred and released over time, it was evident that the colonial institution was gradually gaining a proficiency in acclimatising English trout to local waters.[59]

55 Birtwistle, *ARFD 1930*, p. 315; Birtwistle, *ARFD 1935*, p. 504; Anon., 'Highlands trout experiment', *ST*, 21 June 1935, p. 17.

56 Anon., 'Highlands trout experiment'.

57 It was estimated that eyed ova could be obtained at 12 pence per 1,000; freight charges were relatively inexpensive, and no skilled attention was required. Total cost of transporting, raising, and releasing 100,000 trout ova into the streams of the Highlands was estimated at a relatively affordable $3,500 a year. Birtwistle, *Annual Report 1935,* p. 504; Soong Min Kong, 'Introduction of trout', p. 516; Anon., 'Highlands trout experiment'.

58 Original figure 4 to 6 inches.

59 Anon., 'Newera Eliya', *Eastern Daily Mail and Straits Morning Advertiser*, 11 Apr. 1906, p. 3; Soong Min Kong, 'Report on the trout hatchery at Cameron Highlands', *ARFD 1936*, p. 643; Anon., 'Cameron Highlands trout now weigh 11 pounds', *ST*, 21 July 1937, p.12; Birtwistle, *ARFD 1936*, p. 623; Birtwistle, *ARFD 1938*, p. 486.

The local English expatriate community supported the Department's acclimatisation experiments enthusiastically. In response to the promising statistics, the Cameron Highlands Society predicted 'first class trout fishing, in the Upper Highlands … within the next three or four years'.[60] Reflecting the colonial attitudes of the period, which emphasised (European) man's ability to improve on nature, a contributor to the *Straits Times* breathlessly affirmed that trout 'thrives better in streams into which it has been introduced artificially than in the waters where Nature placed it'.[61] Encoded in these optimistic opinions was a Eurocentric belief that Western science—and by implication, Empire—could overcome perceived shortcomings in the lands (and waters) which it administered. Under these circumstances, and unsurprisingly, the local Anglophone press reported favourably on these English trout. Despite the high mortality rates, journalists wrote approvingly of the liberated juvenile fishes' ability to 'stand up well to the climatic conditions in the Malayan highlands', attributing their endurance to the fact that they came from 'good stock'.[62] In late 1935, the *Malaya Tribune* gleefully reported that the largest trout in the Highlands hatchery, 'now six inches in length', 'rejoices in the name of George', after the reigning English monarch. The fact that the Department fed these plucky hatchlings on 'liver and ox heart', did not escape the notice of the beef-eating English correspondents either.[63] The trout were thus gradually accreting new meanings for themselves in the cultural landscapes of Malaya.

While it is unclear what lowland Malay padi farmers or Chinese labourers felt about these alien trout, or whether they were even aware of their introduction in the highland streams, the Department took steps to win the support of indigenous communities in the Highlands. Birtwistle secured the assistance of local Sakai and Temiar groups by promising 'small rewards' in exchange for detailed information on the trout released into Highland rivers. Against the vocal misgivings of the Anglophone press toward these 'primitive races', and their apparent inability to 'resist the spectacle of a nice plump trout', the Department appointed Temiar and Sakai wardens in 1936 to patrol rivers, clear footpaths, and report regularly on the released trout.[64] These initiatives appear to have paid off, despite colonial reservations: by 1937, a commentator had opined that Sakai guides 'will prove to be an asset rather than a menace … for they will be able to provide a permanent staff of wardens'; Department inspections later that year revealed that 'even close to the Sakai settlements, trout are relatively plentiful'.[65] In 1940, 'fish-watching Sakai' continued to provide detailed information for the Department on trout behaviour in Highland rivers.[66] The support and assistance of local indigenous communities thus proved crucial to the Department's experiments, providing the institution a clearer understanding on

60 Anon., 'Cameron Highlands trout', *MT*, 11 May 1935, p. 10.
61 Anon., 'Notes of the day', *ST*, 27 Jan. 1936, p. 10.
62 Anon., '5,000 trout at Highlands', *ST*, 4 Nov. 1935, p. 13.
63 Six inches is approximately 15.24 cm. Anon., 'Malayan fisheries', *MT*, 1 Nov. 1935, p. 10; Anon., 'Highlands trout experiment', p. 7.
64 Anon., 'The highlands trout', *MT*, 26 Dec. 1935, p. 10; Anon., 'The Sakai and trout', *MT*, 8 Nov. 1935, p. 12; Birtwistle, *ARFD* 1937, p. 573.
65 Anon., 'Notes of the day', 3 Feb. 1937, p. 10; Anon., 'Army sanatorium at Highlands', *ST*, 6 Apr. 1937, p. 16.
66 Anon., 'X-raying Highlands trout', *SFPMA*, 11 Jan. 1940, p. 5.

the health of their introduced trout. Observing and protecting these fish had thus necessitated a further expansion of indirect imperial control over the waterscapes of the Cameron Highlands.[67]

The Department reported in 1937 that the trout released in previous years were 'doing well'. A 'good stock' of the introduced fishes had moreover established themselves in the upper reaches of the Telom, Terla, and Ichat Rivers. A further 12,188 'well grown trout' from earlier batches were released into Highland streams. By 1938, the introduced fishes had become 'fairly well distributed' throughout the Cameron Highlands, with reports of a 'number of very big fish' measuring over 20 centimetres long.[68] Department staff had furthermore detected some signs of spawning amongst female trout in the hatchery ponds, offering some hope for the continued future of the fishery. Given these encouraging figures, the *Malaya Tribune* in August 1938 predicted the opening of trout season in the Telom River shortly.[69]

In early 1939, after years of intense speculation, the long-held colonial aspiration for a recreational trout fishery in the Cameron Highlands was finally realised, with the opening of fishing at the Telom and Bertam Rivers. Despite fishing licences costing an extravagant $10 each, the response was 'encouraging'.[70] Holidaying colonial officials, army officers, and an unexpectedly high number of 'Asiatics' were soon reported to have taken up the sport. The capture of a large, 1.5 kg rainbow trout was celebrated later in April 1939, the 'largest fish yet taken' since the fishery opened to the paying public. In 1941, the *Sunday Tribune* declared that the Cameron Highlands had become 'an angler's paradise', with well-stocked streams, and catches averaging 'more than two pounds'.[71]

Yet despite the effusive praise and the Department's best efforts, English trout ultimately failed to establish themselves in the Highlands. Although the fishes exhibited some tentative signs of courting behaviour, fishery officers observed that the trout remained 'very shy and disinclined to mate'. The advent of the Second World War forestalled any further development of this recreational fishery, as occupying Japanese forces concerned themselves with more pressing economic and logistical issues. Post-war investigations into the Highlands' trout fishery confirmed that the fishes had failed to form 'a permanent population' in Highland streams, due primarily to unfavourable water temperatures. Like the Chinese carp, the trout were temperate fishes that could not, despite the best efforts of colonial scientists, breed in tropical waters.[72]

67 Virginia DeJohn Anderson, *Creatures of Empire*: *How domestic animals transformed early America* (Oxford: Oxford University Press, 2004).

68 Original figure 8 inches.

69 Ibid., p. 573; Birtwistle, *ARFD 1938*, p. 488.

70 To contextualise the cost of this fishing licence, 'unskilled and semi-skilled adult Chinese male labour could expect to earn as a general rule from $20 to $45 per month and female labour from $12 to $45 per month' in 1939. *Straits Settlements Blue Book 1939* (Singapore: GPO), p. 592.

71 2 pounds is approximately 0.9 kg; Anon., 'Trout fishing soon in Cameron Highlands', *MT*, 30 Aug. 1938, p. 12; Anon., 'Fishing is the new popular sport in Malaya', *ST*, 30 Apr. 1939, p. 15; Anon., 'News from the Camerons', *Sunday Tribune* (*Singapore*), 26 Feb. 1939, p. 11; Anon., 'Fish no longer strike—they bite!' *Sunday Tribune (Singapore)*, 25 May 1941, p. 2.

72 Water temperature is a crucial factor in determining the establishment success of an introduced species. Anon., 'Fish research: A reply to the ministry', *ST*, 10 July 1961, p. 6; Britton et al., 'Non-native fishes and climate change', p. 1138; Birtwistle, *ARFD 1937*, p. 591; Darren C.J. Yeo, pers. corr.; Hiroshi Shimizu,

The gradual acclimatisation of trout to Highland waters and the opening of trout fishing in the late 1930s, nonetheless represented significant milestones for imperial ichthyology in Malaya. It was an endeavour which had spanned the globe, and harnessed trans-imperial networks of ichthyological knowledge. As with the two other fishes, biological factors alone do not explain the English trout's introduction into Malaya. Instead, multiple aspects of British imperialism had created the conditions necessary for this ichthyological introduction. The colonial development of the Cameron Highlands as an upland retreat, the local expatriate enthusiasm for recreational trout fishing, the cooperation of local indigenous communities, and the timely presence of a determined Malayan Fisheries Department—all of these factors had coincided to facilitate the brief introduction of English trout, yet another fish of Empire, into montane Malayan rivers.

Conclusion

Recognising gaps in the historical and scientific literature about ichthyological introductions into Malaya during the late colonial period, this article has offered a historicised account of the introduction of three exotic fishes into British Malaya. Evidently, the biological traits of *sepat siam*, Chinese carp, and English trout alone cannot explain why colonial institutions and local communities introduced these fishes to Malayan waterscapes. Yet the underlying cultural, technological, and socio-economic circumstances which led to these ichthyological introductions have not been closely investigated.

In particular, these fishes were introduced within a time and space significantly shaped by British imperialism. Empire brought together, but also profoundly altered, the peoples and places critical for the successful introduction and spread of these alien fishes. From newly opened padi-fields, to artificially dug fish ponds, to highland retreats—s*epat siam*, Chinese carp, and English trout were brought into geographical environments that imperial technologies and processes had drastically altered. In seeking to improve and increase fish supplies in Malaya, the colonial Fisheries Department energetically promoted the introduction and cultivation of what it perceived as valuable food-fish. Its publicity drives and technological innovations exposed diverse, far-flung communities throughout Malaya to new fishes and fish-farming techniques. The demographic transformation of British Malaya had also created a demand for the consumption and cultivation of these exotic fishes. Seeking to improve their incomes, newly settled migrant communities from Borneo, Sumatra, and Java in Krian had taken up the cultivation of *sepat siam*. Immigrant Chinese communities, whose sizable presence in British Malaya were themselves a corollary of colonial immigration policies, had also fuelled the popularity of *sepat siam* and Chinese carp. Similarly, a keen interest in trout angling amongst British Malayan expatriates animated the Department's investigation of English trout, while the institution's rapport with local indigenous peoples provided the Department with detailed information on trout behaviour in highland rivers, extending imperial control indirectly into these montane waterways.

'The Japanese fisheries based in Singapore, 1892–1945', *Journal of Southeast Asian Studies* 28, 2 (1997): 324–44.

These ichthyological introductions were thus also successful because they received the sanction of local communities. Imperial power in Malaya was not absolute. The accelerated spread of *sepat siam* and Chinese carp was only possible because local farmers agreed to cultivate these fishes, despite their initial reservations. Because the Fisheries Department had no coercive means to enforce its policies, colonial science in Malaya also depended heavily on the cooperation of local communities to supply information or assistance. Their willingness to take up the Department's suggestions contributed to the success of any new aquacultural initiatives it mooted. Similarly, the vocal, sustained support of the Malayan expatriate community for trout experiments led to the allocation of significant time and resources for the recreational fishery. This article has thus shown how the widespread colonial introductions of such alien fishes depended on a conversant understanding of local cultural and socioeconomic perspectives. Such complex balances of power contest monolithic depictions of colonial excess, and nuance postcolonial discourses examining the relationships between colonisers and colonised subjects in the British Empire.

Species introductions into late colonial Malaya remains a poorly understood domain in the environmental history of the British Empire, in part due to the dearth of materials on the topic until recently. A closer scrutiny of newly available contemporaneous sources on the Fisheries Department's aquaculture projects, however, can now demonstrate how peoples, places, and processes were linked in dense, intricate chains across the entire span of the British Empire. Though the Malayan Fisheries Department's acclimatisation attempts were largely unsuccessful, these experiments offer a rare freshwater insight into Malaya's environmental history, a subfield dominated at present by the study of cash crops and plantation agriculture.

Sepat siam, Chinese carp, and English trout did not materialise in British Malaya on their own. There were broader, historically contingent processes at play that facilitated their introduction into the diverse cultural, socioeconomic, and ecological landscapes of the Peninsula. Imperial power, colonial institutions, and local communities all contributed toward the introduction of these exotic fishes into Malaya. The fishes of Empire thus offer us a meaningful new lens with which to apprehend the landscapes, communities, and technologies that shaped—and were in turn shaped by—the long shadow of imperial power.