Introduction

Considering Fisheries: Medieval Europe and Its Legacies

The Catch explores historic interactions between two dynamic communities, namely the human societies and the aquatic ecosystems of Europe during western Christendom's medieval millennium, roughly 500–1500 CE. The book traces common patterns, variants, and changes over time in medieval experiences exploiting Europe's diverse fish populations. Human desires, abilities, and impacts played off in sometimes unexpected ways against changing aquatic habitats and fish stocks. Unsatisfied wants and newly available opportunities transformed social and environmental relations, affecting people's experiences of their natural surroundings then and in a much longer term. The Middle Ages look somewhat different when viewed from the water and so do present-day issues in fisheries science and management when seen in perspective of a thousand years long past. One catch for author and readers alike is the difference between discourses of interdisciplinary natural science and of interdisciplinary medieval studies. But that is inherent in environmental history, history studied as if nature matters. This enterprise must aspire to mediate between the two conversations.

I.1 Fish Tales

Humans and fishes, creatures terrestrial and aquatic, inhabit what medieval Europeans conceived as two different elements, earth and water. That they were and are intimately engaged some observers then and now remained wholly oblivious. Others can tell stories, in some way testifying to how fish and fisheries were thought to matter across a millennium and more of Europeans' encounters with life forms in and beyond their own waters. An opening sampler of three tales alerts readers of various backgrounds to the confluence of methods and data sets and to some of the diverse perspectives and issues to be encountered in this realm of interaction between European natures and the medieval cultures that thrived among them.

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I.1.1 Observations and Inferences: The Long Demise of the Atlantic Sturgeon

The sad yet curiously complicated tale of the European Atlantic (or sea) sturgeon[1] begins in distant times, for this family displays many primitive physiological features. Reaching four to six meters and living sixty to a hundred years these creatures of coasts, estuaries, and large rivers consume bottom organisms and small fishes. Spawned over river gravels, the young live for a time in estuarine shallows before slowly growing up to 400 kilograms, making them the largest fish in western European fresh waters. Sturgeons first reproduce after age twelve and thereafter only every few years. They lack bony skeletons, but their backs and sides bear horny plates called scutes which endure in archaeological settings. And sturgeon flesh was historically prized. Roman luxury demand had by the first century CE seriously depleted once abundant stocks in the Rhône estuary. They took centuries to recover.[2]

Early medieval elites continued to enjoy eating sturgeon. A Byzantine physician at the court of Frankish king Theodoric (511–534) recommended it for diners in good health. Centuries later Prüm abbey in Luxembourg required serfs from its Rhine delta manors annually to haul an eleven-foot (three-metre) specimen some 200 kilometers overland or upriver for the monks to eat.[3] Finds from seventh- to ninth-century high-status sites along the southern Baltic coast suggest that sturgeon there provided up to 70 percent of the weight of fish consumed, results corroborated from more recently and precisely excavated tenth-century Gdańsk.[4]

Already by the twelfth century surviving records indicate fishing pressure and drainage projects were reducing the frequency, relative share, and size of harvested sturgeons. In the same south Baltic sites just mentioned, their share fell below 20, even to 10, percent of recovered fish remains. The average size of sturgeon consumed at Gdańsk fell from

[1] Each species of European fishes here mentioned is identified in text by its common English name, where such exists. See the Appendix for the scientific name and some aspects of the organism's habitat. Only in cases of potential ambiguity or unusual need for distinction do scientific or dialect names appear in the text. On European sea sturgeon see www.fishbase.de/summary/Acipenser-sturio.html (last consulted 8 June 2020) and Kottelat and Freyhof, *Handbook*, 57–58.

[2] On Roman taste see Pliny, *Natural History*, lib. 9, §§17 and 27–29. Desse and Desse-Berset, "Pêche et surpêche," 335–337; Desse-Berset, "Sturgeons of the Rhône," 81–90; Sternberg, "Rôle des fleuves dans la pêche," 190–195.

[3] Anthimus, *De observatione ciborum*, ed. Lichtenhahn, 41–42; Schwab, ed., *Prümer Urbar*, 232–33 and 244. Loveluck, *Northwest Europe*, 69–70, 131–132, and 139, reports sturgeon remains at sixth–eighth-century Frisian sites in the Rhine delta and from elite Frankish sites near Lille and on the Marne just upstream of Paris.

[4] Benecke, "Remarks on sturgeon," 9–17; Makowiecki, "Usefulness," 108–109.

the tenth to thirteenth century.[5] Declines in the North Sea drainage were similar. From the river Ems the sturgeon present up to the thirteenth century had vanished by the next. Written records from the Low Countries mark further losses among coastal stocks from the eleventh through the fourteenth century. The genus then disappears from food waste at the castle in Namur and also from archaeological finds at Schaffhausen, the probable upper limit of its range in the Rhine.[6] Thirteenth-century French and English kings claimed exclusive rights to all sturgeons taken in their realms. Throughout coastal Atlantic waters, by late and post-medieval centuries these mythic fish had become a rare and sometimes newsworthy catch. Some chefs even then developed recipes "to make sturgeon from veal."[7] Surviving wall paintings at several English parish churches further reflect the continued cultural resonance of sturgeon, as its distinctive form stands out among the fishes commonly depicted in waters through which St. Christopher carries the Christ Child.[8]

Medieval sturgeon populations in the western Mediterranean, notably Italy, may have been more resilient – or just longer adapted to humanized landscapes and human predation. Tenth- and eleventh-century prelates and local potentates laid claim to specimens pulled from nearby rivers: the archbishop of Ravenna, for instance, had preemptive rights over any *storionem* greater than six feet taken from the Padoreno, a now obliterated tributary of the Po.[9] The fish were deliberately pursued in the late medieval Po, Arno, and Tiber. The latter seems the best studied. Rights to take sturgeon in permanent weirs and traps at Rome's bridges were distinguished from rights to shad and other migratory fishes. Catches from the delta were valued as well.[10] Regulations issued for

[5] *Ibid.*; and Susłowska and Urbanowicz, "Szczątki kostne ryb," 53–65. For like data from other urban and elite sites in northern Poland see Makowiecki, *Historia Ryb*, 110–112 and 115, and Makowiecki, *Hodowla*, 41–42.

[6] Lampen, *Fischerei und Fischhandel*, 208; Boddeke, *Vissen*, 169–174; Pigière et al., "Status as reflected in food refuse," 238–241; Huster-Plogmann and Rehazek, "Historical record versus archaeological data."

[7] *Fleta*, I: 44, ed. Richardson and Sayles, p. 100; Clavel, *L'Animal*, 144–145; *Ménagier*, ed. Brereton and Ferrier, 239–240; Plouvier, "La gastronomie," 154; Hieatt and Butler, eds., *Curye on Inglysch*, 155–156; Hieatt, ed., *Ordinance*, item 93. Some fifteenth-century English menus do show sturgeon being served at royal banquets, but other recipes suggest their possible availability on the (black?) market (Austin, ed., *Fifteenth-Century Cookery*, 10–59, 104, and 115–117; Sutton and Hammond, eds., *Coronation of Richard III*, 292–295; Hieatt, ed., *Ordinance*, item 95).

[8] As discovered by Frederick Buller, *Fish & Fishermen*, 15–16, 55, 74, 97, 105–106, and 135–136. The same scenes in the Krems collection of central European images contain no identifiable sturgeon but I have been unable to learn if the same is true further west.

[9] Montanari, *L'alimentazione contadina*, 281 and 289.

[10] Vendittelli, "Diritti ed impianti," 394–397 and 409–422. Elsewhere see Fumagalli, *Landscapes of Fear*, 137, and Nada Patrone, *Il cibo*, 319.

Rome's fish market in 1405 make special mention of selling portions cut from a sturgeon, about the same time as quantities appropriate for retail sales appear in financial accounts of small merchants in Prato.[11] A few decades later the master chef to the duke of Savoy named sturgeon as a major import to the court and a dish appropriate for luxury dining. Maestro Martino de Como, a Lombard cook in the following generation, included in his recipe collection two for sturgeon which famous Renaissance chef Platina later copied.[12]

Even in the south yields hint at limited availability. Moralist preacher San Bernardino of Siena in 1425 ranked eating sturgeon among the worst signs of a luxurious path to perdition, and humanist Aeneas Silvius Piccolomini become Pope Pius II (1458–1464) celebrated in his *Commentaries* the seven "much prized" sturgeons up to 250 'pounds' from the Tiber delta given to him on a visit to Ostia.[13] Papal courtier and humanist Paolo Giovio's erudite but observant 1524 booklet on the Roman fish market, *De romanis piscibus libellus*, also celebrated at least the literary reputation and memory of sturgeon from the Tiber.[14] Perhaps under long-standing preindustrial conditions Italian sturgeon stocks had stabilized at a level still sufficient for consistent elite use.

The medieval tale of sturgeon thus rests on verbal and material evidence of luxury demand and consumption, which led fishers to seek this large and impressive trophy. Actual medieval capture methods and biological knowledge are unrecorded, though plainly effective enough when accompanied by damage to habitat that stocks everywhere diminished. The downward trend appears across the medieval record. This is not to assert local, much less general, extirpation, but that quantitative evidence from the nineteenth century was unlikely to reflect a pristine stock. Present-day palaoscience, however, reveals diversity previous consumers or fishers could not know.

Giovio and Piccolomini both referred to *sturione*, employing the vulgar Latin and cognate old Germanic root *stur/stor* rather than Pliny's elite Greek-derived *acipenser*. Their usage followed learned and vernacular nomenclature for all sea sturgeons across western Europe. But Latin

[11] Lanconelli, "Gli *Statuta pescivendulorum urbis*," 116–117 (article 36); Marshall, *Local Merchants*, 19.

[12] Scully, ed., "*Du fait de cuysine*," 135 and 164; Faccioli, ed., *Arte*, vol. I, p. 184; Platina, *De honesta voluptate et valetudine* and *Il piacere onesto*, ed Faccioli.

[13] Welch, *Shopping*, 33; Piccolomini, *Commentarii*, lib. XI, cap. 19 (ed. Heck, vol. 2, pp. 694–697, tr. Gragg and Gabel, *Commentaries*, abridged ed., pp. 306 and 308–309). By ancient or nineteenth-century standards this was not a remarkably large sturgeon.

[14] Giovio, "*De romanis piscibus*," cap. iiii (Travi and Penio, eds., pp. 16–26). Giovio's career is studied in Zimmermann, *Paolo Giovio*, which treats this early work on pp. 16 and 64.

writers around the late medieval Baltic applied an originally Celtic (Gallic) vernacular for salmon, *isox/esox*, to several unrelated but notably large fishes. In Poland, for instance, these included the sturgeon documented prior to 1400 in the native Slavic vernacular as *jesiotr*.[15] Until the present century this taxonomic peculiarity remained a mere antiquarian anecdote, as naturalists and after them fish scientists long understood the entire western European sturgeon population from the Baltic to Italy as a single species, European Atlantic sturgeon. In 1758 Swedish biologist Linnaeus gave it the scientific name *Acipenser sturio*.[16]

Early twenty-first-century techniques to extract ancient DNA, however, tell a different story: genetic markers indicate that even by the start of the Neolithic the American Atlantic sturgeon, *Acipenser oxyrinchus*, had colonized northernmost European coasts. The closely related American species is now thought to have arrived through North Atlantic drift currents during one or more of the cold periods which punctuated transition from the Pleistocene to the Holocene, roughly 12,000 years ago. *A. oxyrinchus* spawns successfully in temperatures some degrees colder than does *A. sturio*, and by the Middle Ages was dominant in populations from the North and Baltic Seas east to Lake Ladoga. More balanced sympatric (multi-species) stocks formed along the French Atlantic coast.[17] Most of the sturgeon eaten by early medieval Slavic princes and some of those claimed by French and English rulers were thus of long present but invasive origin. Both human and natural forces could shape the evolution of medieval fish and fisheries. Might what looks like the greater adaptability of Mediterranean sturgeons to human predation even have a genetic basis?

Genetic diversity could not, however, ward off post-medieval pressures on sea sturgeons in European waters. Ongoing human predation, pollution, and physical modifications to rivers have since the nineteenth century continued to suppress sturgeon numbers and the size and age of individuals across its range, resulting in incremental extirpation

[15] Rostafiński, *Średniowieczna historia naturalna*, pt. 1, p. 402.

[16] East-flowing rivers, notably the Danube system, contain several other species of sturgeons, including the migratory beluga (*Huso huso*), famous for its roe and the best caviar (Bartosiewicz et al., "Sturgeon fishing in the middle and lower Danube region").

[17] Thieren et al., "The Holocene occurrence of *Acipenser* spp.," brings together DNA studies of more than 7,000 dated sturgeon remains as well as earlier findings including those of Ludwig et al., "When the American sea sturgeon swam east," 447–448; Ludwig et al., "Further evidence"; Tiedemann et al., "Atlantic sturgeons (*Acipenser sturio*, *Acipenser oxyrinchus*)"; Desse-Berset and Williot, "Emerging questions"; Chassaing et al., "Palaeogenetics of western French sturgeons"; and Galimova et al., "Fish Bones … Staraya Ladoga," 63. Additional DNA results from German rivers are in Nikulina and Schmölcke, "Reconstruction of the historical distribution of sturgeons."

everywhere. In 1991 people took, killed, and proudly ate the last known specimens of *A. sturio* from both the Black Sea and the Mediterranean. The last recorded on the Atlantic coast of Iberia was served in a restaurant in 1992 and the last from the North Sea met a like end the following year. One spawning population may still survive in the Gironde, where, however, the last known success was in 1994, although a juvenile with that genetic marker was taken and released in 2007. Nor do wild American sea sturgeon survive in Europe, as the last in the Baltic was taken in 1996 and in the British Isles in 2005. Of the twenty-five species in the sturgeon family (*Acipenseridae*) worldwide, the International Union for the Conservation of Nature (IUCN) rates nineteen as endangered or worse and only one as "least concern" for extinction.[18]

The separate views of medieval commentators, modern archaeozoologists, and recent geneticists trace the fading trail of a fish of impressive scale, once a key component in estuarine ecosystems, but long coveted by the rich and powerful, so fatally vulnerable.

I.1.2 Communities, Culture, and Sustained Fishing on Lake Constance

While sturgeons never passed the Rhine falls at Schaffhausen, a millennial tale of fishing in medieval Lake Constance (German *Bodensee*) traces evolving sociocultural approaches to diverse freshwater ecosystems in western and central Europe's third largest natural lake.[19] Now bordered by Germany, Switzerland, and Austria, and thus once near the geographical centre of medieval Latin Christendom, the lake's two principal basins, Obersee and Untersee, are joined at Constance by a two-kilometer strait sometimes called the 'Lake Rhine' (*Seerhein*). With cold depths to 252 metres plus extensive shallows, Lake Constance now supports at least fifty fish species, while two endemics, a whitefish and a char, are extinct. Yet this tale is more about humans learning to live with their aquatic neighbours. The evolving significance of the lake's fisheries for medieval contemporaries and for present-day observers

[18] Williot et al., eds., *Biology and conservation of the European sturgeon*, 3–13 *et passim*; Kottelat and Freyhof, *Handbook*, 53–58; www.iucn.org/74928 and http://cmsdata.iucn.org/downloads/species_status_and_population_trend_of_sturgeon_on_the_red_list.pdf (both consulted 10 August 2015).

[19] Lake Geneva holds more water and Balaton covers a greater area. At 536 km^2 Lake Constance is almost twice the size of Lough Neagh, largest body of water in the British Isles, but only 10% that of Sweden's Lake Vänern, largest in medieval western Christendom. From another perspective it is barely 2% the area of Lake Ontario, smallest of the Laurentian Great Lakes of North America.

exemplifies key source genres and issues for wide-ranging enquiry into fisheries throughout western Christendom.

Remains of Neolithic pile dwellings along the lake shore and a passing comment from Pliny (*Nat. Hist.*, IX, 29) confirm pre-medieval fishing in Lake Constance, but the story really begins with sub- and post-Roman Alemannic (Swabian) settlement and arrival of Christian missionaries and monastic foundations during the seventh to ninth centuries. By around 800, traditional accounts made much of the fishing by Gall, a companion 200 years earlier to the wandering Irish monk Columbanus. While the party of exiles lived in the dilapidated Roman town of Bregenz, Gall made nets and fished the lake to supply monks, visitors, and local people alike. When the group left for Italy, illness kept Gall behind. After Gall's recovery he and a skilled local outdoorsman, the deacon Hiltibod, traveled up the little river Steinach to establish a hermitage and there, too, Gall's skill with his nets and some miraculous assistance again delivered the necessary rations.[20]

From local oral tradition later scribes at two great monasteries beside the lake wrote down the *Life* of St. Gall. A century or more after the holy man's death a Benedictine house had been founded on the presumed site of his hermitage. By the mid-ninth century royal Carolingian patronage made this abbey of St. Gallen[21] a major cultural centre and rival with the bishop of Constance over fishing rights on much of the south shore of the Obersee. Meanwhile since 724 what soon became another great Frankish royal abbey had been established on the island of Reichenau in the Untersee. Monks from the communities of St. Gallen, Reichenau, and the twelfth-century Cistercian foundation of Salem on the north shore of the Obersee provide most of the surviving information about use of the lake's fisheries into the thirteenth century.[22]

Knowing that St. Gallen possessed extensive fishing rights in the lake barely ten kilometers away at Rörschach, mid-tenth-century prelates arriving for an inspection assumed the kitchen had ample supplies of fish. This the monks denied, asserting the lake produced few fish at great expense, and hoped thereby to excuse their eating meat.[23] Two generations later the learned Ekkehard IV (*c.* 980–*c.* 1060), who retrospectively reported that tale, was himself well aware of local/regional fishes and their at least occasional presence on monastic tables. Although Ekkehard's

[20] *Vita Galli*, cap. 6–12 and 28, ed. Krusch pp. 252–253, 260–272, and 289–307; tr. Joynt, pp. 72–83 and 103–104.
[21] To avoid confusion with the original hermit I use the German name for the abbey and its town.
[22] Mayer, "Konstanz und St. Gallen"; Rösener, *Reichsabtei Salem*, 51–52.
[23] Ekkehard, *Casus Sancti Galli*, § 105 (Haefele, ed., pp. 212–213).

Benedictiones ad mensam ("Blessings at table") surely emulated not an actual menu but the fish list Isidore of Seville had provided in his sixth-century encyclopedic *Etymologiae*,[24] the Swiss monk named twenty-four 'fishes' (including four synonyms) in a mix of Latin, Latinized German, and local dialect.[25] Ekkehard thus provides the oldest known verbal sign that people around the lake recognized distinct fish varieties, from pike, trout, and char to gudgeon, perch, and chub. Most of them were indigenous to Lake Constance, including its distinctive char ("*Rubelga*", dialect *Rötel*), and one of the whitefishes ("*Illanch allemannia*" reflecting dialect "*rinanke*", most likely modern so-called Blaufelchen, *Coregonus wartmanni*[26]).

About the same time as Ekkehard at St. Gallen was cataloging and at least thinking to eat many fishes from the lake,[27] over at Reichenau a contingent of fishers, specialized abbey servants, were among the few non-monks permitted to live on the holy island. Their situation, and thus that of people who actually worked at the fishery, becomes clear at some point in the 1140s–50s, when Reichenau set out procedures for its cellarer's office, the agency responsible for the abbey economy.[28] Growing hemp to make rope for fishing nets was an obligation of all peasant tenures, while manors along streams tributary to the Untersee were to build boats and provide annual cartloads of stakes and willow branches for making fish traps. Four fisher's tenures located on the mainland where the modern causeway leads to the island were to fish

[24] Isidore, *Etymologiae*, lib. 12, cap. 6 (ed. and tr. André, pp. 180–223; tr. Barney et al., pp. 259–263, although the latter's translations are untrustworthy) mentions more than fifty aquatic taxa, but of those only the grayling (*thymallus*) and trout (*trocta*) are to be found in the fresh waters of the upper Rhine basin and only the eel (*anguilla*) would likely migrate into them.

[25] Ekkehard, *Benedictiones*, ed. Egli, 285–289. Duft, *Bodensee*, 21–23 and 90–91, Schulz, *Essen und Trinken*, 586–593 (which includes a reprint of Egli's text), and works there cited correct the reading and contest the interpretation of Egli, "Küchenzettel." To call this a 'menu' is hyperbole, but while Isidore had cobbled together fanciful etymologies of classical Latin names for Mediterranean and mythic aquatic creatures, Ekkehard plainly knew his local fishes (including the beaver (*fiber piscis*), understood as dwelling in water with other 'fishes').

[26] For one authoritative view of the 'species swarm' or sympatry among at least four, possibly six, distinct populations of whitefishes (genus *Coregonus*) in Lake Constance, see Kottelat and Freyhof, *Handbook*, 361–364, and more generally 350. Other fish taxonomists may differ.

[27] Sadly, while the monastic library at St. Gallen is rich beyond imagination, the administrative archive normally so useful for environmental and economic historians is notably thin, medieval records reportedly having been discarded in the mid-eighteenth century to free up storage space.

[28] Rösener, *Grundherrschaft*, 223–227 and 234–235, uses the text from Schulte, "Die Urkunde," 352–353, who showed this so-called *Kelleramtordnung* was falsely backdated to the ninth century. No fish are named.

each morning for the abbey and receive their midday meal when they delivered the catch. In cold seasons they ran the seine through the mouth of the Rhine channel (where prized whitefish then spawned) but after Easter they worked shoreline reed beds. The labour of servants and subjects with traditional local knowledge served the culturally determined dietary needs of the monks

But the economic autarky of the old abbeys was fading. While Cistercians were established in 1138 at Salem, about as far inland from the northwestern arm of the Obersee as St. Gallen was from the south shore, only a century later do the newer abbey's archives exhibit active interests in the lake fishery. In 1260 a share in a site to pull a seine net near Constance was yielding annual dues of 2,000 whitefish. When the monks acquired from a local knightly family full control over this site in 1290, it alone annually gave them 15,000 "dried fish which are commonly called gangfish" (*piscium aridorum, qui vulgariter dicuntur gangvische*).[29] These were not, however, the product of specialized servants, but caught and processed by independent leaseholders (legally termed 'fief-holders').

While voices of the religious dominate the lake's early record, less articulate, literate, or durable lay lords and lakeside communities also acquired fishing rights from the crown or by simple undisputed exercise. Common rights of use in the Obersee extended over areas not in the recognized private possession of individuals or urban communities. This comprised all the offshore waters of the main lake basin. While some ordinary citizens of Constance possessed their own private fisheries, the city limited use of its municipal waters to recognized fishers, who had also the right to fish elsewhere in the lake.[30] From at latest some time in the 1200s these artisans sold their catch at a public market on the shore, where archaeologists have turned up remains of pike, carp, and unidentified members of the carp family (*Cyprinidae* sp.) older than 1350. Material from this site was not sieved, so whereas large bones of large fishes are identifiable, not so the smaller and less durable remains of whitefishes and other species of potential interest.[31] Both the documents of traditional history and the material remains of archaeology are

[29] Early generations of Cistercians were almost entirely vegetarian, eating only tiny amounts of fish. Mone, "Ueber die Flußfischerei," 72 n. 4; Staiger, *Salem*, 95–97; Rösener, *Reichsabtei Salem*, 51–52. *Gangfisch* were and are a local delicacy, small egg-filled whitefish taken before the spawn, salted down, and then smoked.

[30] Cahn, *Recht der Binnenfischerei*, 86–87.

[31] Prillof, *Tierknochen*, 18 and 211–212. The carp themselves may here be thought an invasive species, having arrived from the lower Danube into the Rhine basin only since around 1000.

somewhat skewed samples calling for critical assessment to provide a partial view of people and environments in past time. By the late thirteenth century, pressures from concentrated urban demand called up local measures to regulate fishing and fish sales in the interest of consumers and subsequent formation of self-governing fishers' guilds under town supervision. Guilds in Constance and Lindau emerged as leading voices respectively in the west and east ends of the lake. Ever more people and interests were engaged with the lake's fisheries.

Several late medieval developments and events impinged on human relations with the lake. As elsewhere, growth of even fairly small urban populations concentrated flows of organic effluents into nearby waters. Between the thirteenth century and the sixteenth a lagoon-like shoreline at Constance gradually filled with town wastes. From layers of those deposits the remains of plants native to clean waters gradually disappear, replaced by a filamentous algae closely associated with strongly eutrophic or polluted conditions.[32] Consumer doubts about sharp business practices on the waterfront surface in a satirical dialect poem from about 1400. In *Des Teufels Netz* the devil explains how he drags off to hell in his net sinners of all sorts: fishers and fishmongers end up there for taking both small and large fish, keeping the catch too long in their boats, and splashing dead fish with water to appear fresh on the sale table. Honest dealers, though, evade the devil by smoking the dead ones to make the dried fish good to eat.[33]

Then in 1414 a council of the western church assembled in Constance to resolve, among other matters, the competitive presence of not two but three rival popes. Some 600 prelates, princes, professors, and ambassadors plus untold servants and hangers-on streamed into a town with probably closer to three than five thousand inhabitants. Many visitors stayed for almost four years. Their dietary needs likely tested even the honest fishmongers and the entire lake-based ecosystem. According to eyewitness burger Ulrich Richental, a joint commission of church and town councillors so managed markets and prices of victuals, notably including fish, that neither inflation nor supply shortage marred the council sessions. When bread went for a pfennig the loaf, and beef at 3pf the pound, the lake supplied pike, carp, tench, bream and the larger whitefish called *felchen* at 12–20 pf the pound and several small species such as gudgeon or dace at 24–27pf the 'measure'. But the *ganckvisch*,

[32] Küster, "Mittelalterliche Eingriffe," 72.

[33] Barack, ed., *Des Teufels Netz*, ll. 9593–9685. Ehlers, *Des Teufels Netz*, 9–15, notes the survival of five different and independent manuscript redactions and places the anonymous author in the vicinity of Lake Constance about the turn of the century.

salt or fresh, had no set price. Imports were necessary: salt sturgeon from Lombardy; large and small *stockvisch*, meaning air- or salt-dried headless cod from Norway, Iceland, or shores of the North Sea; brined herring; and from Verona the big Lake Garda trout preserved in oil.[34] If not earlier the case, the council brought fishing and fish consumption around Lake Constance into a western European network of trade in preserved fishes from widely scattered aquatic ecosystems.

Whether triggered by the council or not, ensuing human generations around the lake undertook precocious vernacular writings on local fishes, both when to eat them and how to catch them. Already in 1416 Johannes Schenklin, a cleric at Wil, managerial centre of the St. Gallen abbot's estates, glossed into a liturgical manuscript a *Nota de piscibus*, calendaring the two best to eat in each month. Of the two dozen varieties, all named in dialect, one cannot now be identified, three (huchen, salmon, and eel) were not native or present in Lake Constance but available nearby, and the remaining twenty all indigenous, five in genus *Coregonus*. In ensuing decades Schenklin's list was at least twice recopied into other St. Gallen manuscripts.[35] A choir monk, Gall Kemly, was more original, writing up in 1469 and again shortly before his death in 1477 a catalog "On varieties of fishes and the time for eating them" (*De piscium generibus et tempore comestionis ipsorum*) with seasonal and culinary advice about twenty-seven locally available fishes.[36] Compared to Ekkehard some four centuries earlier these independent texts share much greater familiarity with the lake's diverse taxa and local vernacular taxonomy.

An anonymous mid-century townsman whose dialect and references indicate he lived near the lake's outlet considered the other end of the cultural processes which transformed fishes from swimming organisms to a diner's plate. This fellow assembled a memorandum of twenty-nine recipes of baits "*Vische zů vahen*" ("to catch fish"). Into a loose collection

[34] Richental, *Konzilschronik*, facsimile fols. 22b–26a; Loomis tr., pp. 98–101, misidentifies several of the fishes.

[35] Stiftsbibliothek St. Gallen, Codex Csg 1050, pp. 74–75, is Schenklin's autograph, and in Csg 26, pp. 1–12, his information plus some medicinal remarks is glossed into the calendar of a liturgical manuscript done elsewhere but appropriate to the liturgy of St. Gallen. For commentary, not necessarily well informed of fishes or other early writings on them, see Wickersheimer, "Zur Fischdiätetik," 414–415, and Duft, *Bodensee*, 23 and 91.

[36] Kemly's texts appear in Csg 919, pp. 220–221, and Zentralbibliothek Zürich, cod. C 150, fols. 46r–47r, and receive cursory treatment in Wickersheimer, "Zur Fischdiätetik," 412–414, and Duft, *Bodensee*, 23 and 91. Kemly's catalog would resurface in 1490 as "*Hie merck was zeyt und monat im iar ein iegelicher visch am besten sey*" in the printing of *Der Pfaffe von Kalenberg* by Heinrich Knoblochtzer at Heidelberg and in several later publications. See for the latter Hoffmann, *Fishers' Craft*, 31–52 and 92–95.

of household information he included instructions for baits to put on hooks or in traps, for attracting fish by olfactory or quasi-magical means, and for making a snorkel.[37] Like similar fifteenth-century textual objects elsewhere, this manuscript brought into a literate cultural sphere knowledge hitherto transmitted orally among professional and household fishers. At the end of our period Gregor Mangolt, a Protestant bookseller exiled from Habsburg Constance in 1548, assembled both the capture and the cooking of the lake's fishes into a single *Fischbouch*.[38] This illustrated and soon printed handbook brought the regional fishery into the sixteenth-century discourse of an emerging scientific ichthyology.

Intensified contemporary concern for regional fish supplies manifested itself in several ways. Ulrich Rösch, abbot of St. Gallen 1463–1491, is credited with restoring the abbey's long-neglected governance and economy, so laying the foundation for its early modern survival as a religious community and lordship. His regard for fisheries was reflected in acquisition and revindication of fishing rights on the lake and close supervision of the fishing 'fiefs' let out for annual rents in fish or cash. Sadly, the internal management records which would reveal the operation of abbey fisheries during his tenure as abbot or earlier as cellarer (1453–1463) survive only in fragments. The kitchen ordinance Rösch instituted about 1480 called for fish in the regular weekly round of meals on Wednesdays, Fridays, and Saturdays. His kitchen master was to buy herring and stockfish as needed and serve the latter at least once a week.[39] Seeking more secure and ample supplies of fresh fish, in 1483 Rösch undertook to move the entire abbey to lakeside Rörschach (for barely five years until angry townsmen tore down the still half-built structure).[40]

The abbot further sought to increase fish supplies by constructing ponds (*Weiher*) on many abbey properties, some of them meant to rear

[37] Hoffmeister, "Fischer- und Tauchertexte," provides an introduction and transcription of Donaueschingen Schlossbibliothek cod. 792, fols. 48r–55v. The only varieties named are eel and crayfish. For discussion of this form of recipe collection see Hoffmann, *Fishers' Craft*, 322–325, and compare a distinctly more ordered manuscript tract produced about the same time as transcribed and discussed in Hoffmann, "Haslinger Breviary," 9–12 and 16.

[38] Mangolt, *Fischbouch*. For the author's biography and the unusual relationship between the original manuscript, the pirated printing of 1557, and the author's revision now Zürich Stadtbibliothek Ms Simmler 425, see both Mayer's edition of 1905, 121–126, and the commentary in Ribi, *Fischbenennung des Unterseegebietes*, 59–79.

[39] Schwarz, "Küchenordnung," 271–276.

[40] Vogler, "Wirtschafts- und Finanzpolitik," notably 138–141 and 153–164. Duft, *Bodensee*, 91–92, quotes the contemporary chronicle for Rösch's reasoning: *"Item nützlich vnd fruchtpar den gaistlichen vne trostlichen zü ewigen zitten mitt fürbindigen guten vischen, nach jettlichem zit, vnd allweg frisch vnd vmb ain rechten pfening, daran der gaistlichait vil gelegen ist."*

carp. Other Swiss landowners since at latest the 1460s were obtaining juvenile carp from Lake Constance to stock their own ponds.[41] Financial records from Salem covering 1489–1530 likewise document not only extensive fishponds but regular purchases of dried cod and brined herring as well as heavy Lenten consumption of the lake's own *gangvisch* and *felchen*.[42]

Persistent and widespread concern for fish supplies in the growing and prosperous region around fifteenth-century Lake Constance provided context for an accelerating shift from open exploitation or local guild and municipal control of fisheries to collective joint management of the lake for sake of sustainability.[43] Having established their own regimes to protect consumers and reduce disruptive conflicts among fishers, towns and guilds began in mid-century to impose rules protecting young fish, bleak, perch, and whitefish, by seasonal closures and bans on specific kinds of nets. Minimum sizes and maximum legitimate catches ensued. With so much of the main lake open to common use – though effectively accessible only to well-equipped professionals – individual jurisdictions had, however, limited effect. Multilateral agreements among urban and seigneurial powers curbed competition and eased enforcement. Constance, Überlingen, and the principalities of Salem, Mainau, and Heiligenberg entered into a regulatory treaty in 1481. The parties' enlarged agreement of 1536 was emulated for the lake's eastern end under Lindau's leadership (1537). Abbey lordships did likewise, with Reichenau setting rules for the Untersee about 1450 and refining their terms at decadal or shorter intervals. St. Gallen turned its own regulations into a treaty for the entire south shore in 1544. This regulatory regime lasted into the nineteenth century and then only gave way to an international joint commission.

As early as 1531 the master of the Constance fishers' guild clearly articulated in a letter to his counterpart in Überlingen the rationale underlying all the regulatory measures: "Were all other fishers to hold to such an ordinance and spare the young fishes, this lake would again be as rich in fish as it is otherwise almost emptied [of them]." Pointing out that one winter's protection of young perch yielded fishers of Thurgau many more adults the next summer, he continued, "A like idea also

[41] Amacher, "Teichwirtschaft," 83. See also Häberle and Marti-Grädel, "Teichwirtschaft," 151–157, and Hoffmann, "Der Karpfen," 163–166.
[42] Ammann, "Untersuchungen … Kloster Salem," 286–287.
[43] An environmental understanding of late medieval and early modern fisheries regulation on Lake Constance is the achievement of Michael Zeheter. For what follows see his "To prevent a disorder" and *Ordnung*, notably 82–116.

applies to the juvenile whitefish and other fishes. A pail of juveniles left uncaught would a year later give a heap of *gangvisch*."[44]

For more than 500 years medieval residents around Lake Constance saw ideological and economic value in its fishes. This motivated their cultural interest and institutional structures to exploit this resource. People of the lake were familiar with various fish varieties, knew how to catch them, and ways to get that catch from the water to consumers both promptly and in preserved form also for later use. By the last medieval centuries, if not before, they were aware of their own effect on the resource. As well as considering substitutes reared in artificial ponds or imported from afar, these medieval Europeans devised methods to sustain natural wild stocks. The latter strategy even transcended competition between different groups among fishers and among consumers. While challenged by human impacts in subsequent ages, Lake Constance remains a viable fishery a half-millennium later still.

I.1.3 From Fish to Commodity

Unlike sturgeon or whitefishes, cod are probably familiar, at least on the dining table, to many present consumers – or would be if more fisheries still survived and marketers less pirated the well-known name to apply to more or less distantly related white-fleshed fishes from elsewhere. Atlantic cod is a marine creature, so fitting the modernist misapprehension of most consumers and writers that fish of economic significance always come from the sea. Atlantic cod are bottom-oriented open ocean apex predators in a range along shorelines and continental shelves spanning cold North Atlantic waters.[45] Without here going into detail, historically important stocks include those off arctic Norway, around Iceland, in the North Sea, and on the oceanic banks between Newfoundland and Cape Cod. Where abundant, cod are considered keystone species, as their predation shapes relationships among other animals in their ecosystem. Recent research has shown cod to be highly sensitive to temperature fluctuations and other environmental stresses. Diners can enjoy the delicate white flesh of cod for the same reason it can easily be preserved by drying or salting: fish of the cod family

[44] *Wiewol ich achten wo all ander vischer wer wie ain ordnung hielten und volab der jugent vischenten dieser [See] werd wider vischrich so er sunst vast erlärt ist … Ain gliche maindg hats ouch mit den selen und andern vischen. Ain pfe____er* [*pfeimern?*] *selen (deren wir kainr niender fahen wrent) gäb aber ain Jar ain hufen gangkfisch*. Transcription from Stadtarchiv Überlingen C976/ thanks to Michael Zeheter. Translation by the present author.

[45] www.fishbase.org/summary/Gadus-morhua.html (consulted 8 August 2015) and references there provide information not otherwise cited below.

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(*Gadidae*, gadids or gadoids) store energy as oil in their livers rather than muscles (unlike, for example, tunas, mackerels, and salmonids).

The deepest history of cod fishing and consumption belongs to arctic Norway, where seasonal nearshore spawning concentrations of large cods and frigid but dry late winter conditions enabled coast dwellers since the Bronze Age to produce stockfish, the board-like slabs of cod dried without need for salt. Up to modern times fishers took cod with baited hooks sunk to the bottom, whether on individual hand lines or long lines with many hooks. Processing into stockfish leaves middens of skeletal remains (heads, anterior vertebrae) which identify a key subsistence good and the store of capital behind Iron Age chieftaincies there. Ninth-century Norse settlers in Orkney and Iceland carried with them the same pattern of resource use.[46] Europeans elsewhere then made no significant efforts to exploit inshore stocks of smaller cod.

The Viking Age (*c.* 800–1080) initiated a southwards expansion of taste for cod, followed by export of northern stockfish to societies in northwestern Europe.[47] Tenth-century trash heaps where Scandinavians settled in eastern England and northern Scotland held remains of headless cods (i.e. stockfish), but ensuing generations at York and London substituted local catches of cods and other gadids from the North Sea.[48] By sometime in the twelfth century fishing for cod had become ubiquitous in those waters, with at least some of the take salted down for future consumption or commerce.[49] Norwegian exports grew simultaneously. During the thirteenth and fourteenth centuries large shipments of northern stockfish passed regularly through Bergen to consumers in England, north Germany, and the Baltic. Traders from the Hanse towns of northern Germany handled the greater share, followed by the English, but as the one legal point of exchange Bergen grew into Norway's chief urban and commercial centre. All of these fisheries and trades achieved their highest volume in decades around 1300, when human numbers also reached their medieval zenith. Even so, fishing and eating cod were less

[46] Perdikaris, "Scaly heads and tales," and "Chiefly provisioning"; Barrett, "Farming and fishing"; Barrett et al., "Archaeo-ichthyological evidence"; Barrett, *Being an Islander*; Perdikaris and McGovern, "Codfish and kings" and "Viking Age economics."

[47] Barrett et al., "'Dark Age economics' revisited," the now-classic statement on origins of marine fishing for cod and other species in northwestern Europe, is more broadly nuanced and grounded in Barrett, "Medieval sea fishing" and the essays in Barrett and Orton, eds., *Cod and Herring*, some of which are cited individually in what follows.

[48] Harland et al., "Fishing and fish trade"; Orton et al., "Fish for London."

[49] For much of what follows see the concluding overview in Barrett and Orton, eds., *Cod and Herring*, namely Barrett's own "Medieval sea fishing, AD 500–1550," notably 253–262. Details for England are in Kowaleski, "Commercialization" and "Early documentary evidence."

common in the high and late medieval Low Countries, where inshore waters supported good concentrations of other gadids (whiting) and flatfishes.[50] On more southerly tables cod would be hard to find before roughly 1350.

During late medieval centuries consumption of cod deepened in some western regions and spread haltingly eastwards and southwards into places where no such fish ever lived. Origins and features of the product changed as well. Consumption of Nordic cods at London and York peaked in the early 1300s, when stockfish from Iceland first entered the market. After some post-plague generations of diminished demand, English consumption of northern catches, now mainly of Icelandic origin, revived only briefly in the mid-fifteenth century. Much more salt-dried or even wet-salted cod from stocks around the British Isles more than took up any slack, since about 1400 this species surpassed herring as the principal source of fish flesh in English diets. Boat owners in both eastern and southwestern England replaced crews working on shares with individually hired hands. As DNA analysis of cod remains from the *Mary Rose* (sank 1545) has brought home, after 1500 large cod of Atlantic origin supplemented regional sources of supply. Across the northern European mainland, too, fifteenth-century markets and tables came to hold cod in different preserved forms from various distant and local sources.[51]

After centuries of lag, from around 1400 cod did begin to penetrate more southerly markets and diets. This growth relied as much on use of salt to preserve catches from coastal stocks as it did on expansion of the dried stockfish industry. In interior central Europe, stockfish were among the victuals with managed prices during the Council of Constance, but the Alsatian chef there hired by the council's elected pope reported they were for Thuringians, Hessians, and Swabians, not the French or Italians.[52] An occasional stockfish recipe crops up in fifteenth-century

[50] On Norwegian exports, see Nedkvitne, *Hansa and Bergen*, 25–96, and summarized in his "Development." For the Baltic the vast historiography on Hanseatic trade receives material content in Holm, "Commercial sea fisheries," 18–19; Makowiecki et al., "Cod and herring," 123–129; and Lõugas, "Fishing and fish trade." For sparse representation of cod on Flemish markets and sites until the very late 1400s see Van Neer and Ervynck, "Rise of sea-fish consumption," 159–167.

[51] Nedkvitne, *Hansa and Bergen*, 96–249; Barrett, "Medieval sea fishing," 262–264; Harland et al., "Fish and fish trade," 191–196 and tables 15.2–15.3; Orton et al., "Fish for the city"; Orton et al., "Fish for London"; Locker, *Role of Stored Fish*, 282; Hamilton-Dyer, "Fish in Tudor naval diet"; Hutchinson et al., "Globalization of naval provisioning"; and Clavel, *L'Animal*, 162–163.

[52] Richental, *Konzilschronik*, fol. 25b (tr. Loomis, p. 101), where reading of *stockvisch* as 'salt cod' seems to me dubious. On Germans' taste for these fish see Laurioux, ed., "Le 'Registre de cuisine'," pp. 741–742 (recipe nr. 69). Prillof, *Tierknochen*, 18 and 212, reports cod vertebrae from the Constance market site dating *c.* 1450.

Bavarian and Austrian cookbooks, but no such traces in their kitchen middens or even their kitchen accounts. Further to the south and west the prevalent preserved white-fleshed fish was hake, the resident bottom-oriented predatory gadid in the Channel Approaches and Bay of Biscay. Historical confusion reigns when incautious modern writers translate *merluz*, *merluccio*, and like words as 'stockfish', not the distinctly smaller hake taken and salt-dried by fishers from Cornwall and Brittany south to Galicia and Portugal.[53] In Spain and Italy, as in France, salt-dried cod were a new product characteristic of the sixteenth century. Papal courtier Paolo Giovio, whom we met praising the sturgeons of Rome, may epitomize the ambiguity and transition to a stiff and headless commodity:

> Also there are brought from the bounds of Sweden and Norway arm-long *merlucciae*, so hard and stretched out as to be like boards, which we see to be the choice of the Germans who inhabit the city.[54]

Even in 1524 the fish of far northern origin remained alien to native Romans. An age of *baccalà* was yet to come. In any case, this commodity was far far away from any living fish elsewhere called cod.

Even as Giovio wrote the cod tale was changing. In a story less widely known than it deserves, a Venetian navigator financed in part by Bristol merchants whom Hanseatic competition had squeezed out of the Bergen market and Icelandic fishery found his way to a bonanza of cod in the western Atlantic and back to England to spread the news. One of Zuan Caboto's English crewmen in 1497 told a Spanish intelligence agent of unimaginable abundance off the "New found land," which would free English mariners and markets from dependence on Iceland. The Cabot circle would later speak of "infinite fish."[55] First to exploit the hitherto untouched Grand Banks were Portuguese (1506), Normans (1508), Basques and Bretons (1511). Yet within a generation relations between humans and fish in the northwest Atlantic were transformed.[56] Soon French, English, Spanish, and eventually American boats and fleets would compete for those rich schools through a half-millennium. By the late sixteenth century European markets, diets, coastal settlements, and

[53] See for instance Kowaleski, "Expansion"; Hocquet, "Pêcheries médiévales," 86–87, 96–98, and 111–112; Kerhervé, *L'État breton*, 686–692; and Ferreira Priegue, "Pesca y economia."

[54] *Adducuntur quoque ex finibus Gothiae atque Norvegiae cubitales merlucciae, adeo durae et extentae, ut fustibus assimilentur, quas in delitiis Germanorum, qui Urbem incolunt, esse videmus.* Giovio, *De romanis piscibus*, cap. xlii (p. 60).

[55] Williamson, ed., *Cabot Voyages*, 207–214, 266–268, and 297. Later writers, notably Zuan's son Sebastian, asserted fish so abundant they "stayed the passage of his ships."

[56] Holm et al., "North Atlantic fish revolution," puts the early modern case in a progressive economic mode.

fisheries politics felt waves of the revolutionary disruption radiating from the epicentre off Newfoundland. Salt-dried cod went to markets in Spain, Portugal, Italy, southern France, and eventually to Caribbean plantations as rations for slaves. The English colony become Commonwealth of Massachusetts would make a sculptured golden cod a symbol of its autonomy, but what reached distant consumers were hard, headless, salt-encrusted slabs.

Fast forward five centuries: environmentally aware consumers now think of cod fisheries in terms of competition and collapse. While fisheries experts and contemporary historians continue to debate the relative roles in the cod debacle of the late twentieth century of overfishing, of mismanagement, and of environmental change (regional fluctuations in water temperatures),[57] in a longer view all this was 'new' only in scale. Since documented European discovery of the banks between New England and Newfoundland, the prevalent cultural regime has sought to satisfy as much demand and to fish as intensively, as available technologies for capture and preservation would allow. Perhaps already by 1600 and surely in the late seventeenth century and again from the mid-nineteenth, shortfalls in catches caused some local observers to worry about disruption of aquatic life and future depletion. But each time new technologies and practices (long multi-hook lines, nets and trawls, steam power, factory ships), new fishing frontiers (further offshore, further north, longer seasons), and a shared desire for wealth and prosperity pushed the catches up, changed the sense of normal abundance (what ecologists call the 'shifting baseline syndrome'), and let both decision-makers and fishers set aside all doubts.[58] The ever greater distance of investors, managers, and consumers from the waters and from the live animals made decisions easier, too.

The sorry tale of late twentieth-century cod is a reasonably clear progression from the late fifteenth-century arrival of medieval Europeans in the western Atlantic and its 'infinite fish'. But what lay behind this evolution? Had it anything to do with European experience of the cod and, by reasonable extension, other fisheries during the previous medieval millennium? How and why the parallels between the long demise of the sturgeon and the collapse of the cod in one-third the time? What had fishers of Lake Constance been able to learn and others not?

[57] Rose, *Cod: The Ecological History*; Bavington, "From hunting fish to managing populations" and *Managed Annihilation*. Further online in Supplement 0.1.2.

[58] A narrative developed in evocative detail by Bolster, *Mortal Sea*, and sustained with documentary precision in Pope, "Early estimates," 12 and 27.

I.1.4 Telling Tales in Time and Space

Whether centred on a natural organism, human groups, or the natural and historic settings of their encounters, our three fish tales offer glimpses of medieval Europeans interacting with surrounding aquatic nature. Sea sturgeons swam at the centre of a story of human desire to possess and consume an impressive, very distinctive fish. Common people worked in the natural world so medieval elites of wealth and power could enjoy this increasingly rare trophy. Attributes of the animal itself framed human efforts and impacts on aquatic ecosystems as well as the response of sturgeon populations to those pressures. The tale of Lake Constance revolved around medieval communities living beside a particular water body and turning to it for important corporeal and cultural needs. They successively adapted techniques and skills to exploit diverse fish stocks within their evolving sociopolitical structures – subsistence, lordships, urban markets – and their cultural understandings. Aware of pressures on resources, leading elements in regional society responded in several practical ways.

Even in the cursory form given here the three-act story of cod covered the longest time and widest stage. Millennia of local subsistence use anchored the narrative and even some of its durable technical features off northern coastal Norway. Across five subsequent medieval centuries northern fishing evolved into commercial production of a standardized commodity for long-distance trade even as its methods came to be emulated by regional societies elsewhere in the fish's range. Better access to resources (salt) let late adopters develop superior (or at least cheaper) techniques for preservation and thus commerce. Fishers but especially traders in cod early helped build a European network of interregional trade later joined by, for instance, the Lake Constance fishery. The end of the Middle Ages initiated a new five-century global expansion of cod which widened the gap – spatial, economic, perceptual – separating the animal and its fishers from the commodity and its consumers. Competitive conflicts meant dominant interest groups (nations, investors, traders) responded to successive waves of depletion with separate, even contradictory, technological and finally reluctant regulatory measures.

Every historic aspect, attribute, and evolution in these fish tales will recur in the wider exploration of western Christendom's encounters with its aquatic environments. Different habitats affect biodiversity and the resources accessible to local human communities. Economic institutions evolved differently across Europe's many regions. Species characteristics and consumption patterns shaped potential for innovation in catching, preserving, and marketing fish. Some themes can be seen as shared

across broad areas, but the particulars will differ. Medieval fisheries are not all one story. The tales simply indicate some patterns and variations.

Each tale has further been informed by a confluence of methods and data sets. These few pages have drawn upon ichthyology and ecology of present experience with fishes as well as the methods and findings of archaeozoology which can make sense of recovered remains of fishes long dead and (mostly) eaten. In the traditional historians' written record critical readings of various documentary types and genres indicated something of past writers' purposes, perceptions, and unintentional assumptions, even ignorance, regarding the natural world in general and fishes in particular. Integrated with these anthropogenic remnants of the medieval European past are the findings of palaeoscience, the present-day recovery of natural features such as ancient DNA, climate proxies, trace elements, and stable isotopes unimagined by medieval people. The interdisciplinary approaches deployed as opportune in the fairly simple fish tales will help call up a more diverse but interwoven understanding of people and fishes across western Christendom's medieval millennium and something of the legacy their experiences, actions, and consequences left for their future, which is our present.

From northern Norway to Sicily and Ireland to the Danube, European habitats held a multiplicity of aquatic creatures. Medieval regional vernacular cultures knew equally variegated vocabularies for those animals and for the means by which people caught them. Though acknowledging both the biogeographical integrity of European waters and the cultural unities of western Latin Christendom, most studies of fish and fisheries and nearly all of those with historical or antiquarian intent have (understandably) been local, regional, or at most national in scope. Yet only rare highly localized species are confined to a single country, and many European watersheds and coasts encompass several modern (and medieval) polities.[59] National, regional or single-species studies – Danish

[59] Robinson and Starkey, "Sea fisheries of the British Isles," 121–122, in 1996 rightly criticized their predecessors for lack of context and narrowly national perspectives. Their essay and the ongoing research and publications such as Roberts, *Unnatural History of the Sea* (2007) and works of the History of Marine Animals Project (HMAP) actively and successfully build toward broader and more ecologically informed approaches (see, for example, Holm et al., "Marine animal populations," 3–23). Further progress is evident in Rick and Erlandson, eds, *Human Impacts on Ancient Marine Ecosystems*, an important collective effort from mainly archaeological perspectives; in the essay "Of seascapes and people" wherein historian-editors Kathleen Schwerdtner Mánez and Bo Poulsen introduce their innovative multidisciplinary *Perspectives on Oceans Past*; and in the collective prolegomonon of Holm et al., "North Atlantic Fish Revolution." Yet little of this excellent work in marine environmental history or historical ecology thinks to link with freshwater fisheries science, history, or other scholarship.

herrings, Norwegian cod, English fishers, etc. – neglect competitors on the water and in broader markets as well as other species of some regional importance. Customary separation of fisheries studies into freshwater and marine pools simply violates the commonalities of aquatic life and of terrestrial humans engaging with creatures from another medium. Most medieval Europeans lived far from the sea and, as will appear below, medieval fishing long remained a primarily inland and coastal activity carried out within sight of land. For all these reasons, this book attempts European, not territorial or salinity-based, coverage. As a work of environmental history it aims to explore and tell tales of a thousand years of encounters between the cultural community of western Christendom and the animals and ecosystems of waters flowing through and washing the bounds of that community.

I.2 Doing Environmental History

I.2.1 Interactions: Nature and Human Culture, People and Places

An effective environmental history can avoid a priori assumptions of environmental, material, or cultural determinism by starting from the palpably human constructs of 'Culture' and 'Nature' as identifying two autonomous realms of identity and causation.[60] The former comprises the means by which humans comprehend and communicate their own being and the world around them. Such communication creates human knowledge, beliefs, institutions, and purposes. Everything from divinely ordained dietary rules to seigneurial authority and markets to metaphysics is a learned element of culture. The latter, 'Nature', refers to the material universe, living and non-living, and its operations free of human (or evident supernatural) wishes or cultural preferences. 'Laws of Nature' describe, among other things, how flows of energy and matter (carbon, nitrogen, oxygen, etc.) link living organisms to one another and

[60] Hoffmann, *Environmental History*, 3–16, more fully discusses methods for environmental history. For a similar way of thinking with different conceptual vocabulary see the multi-authored essays "Historical ecology and the longue durée" and "Concepts for integrated research in historical ecology" in Crumley et al., eds., *Issues and Concepts in Historical Ecology*, 13–40 and 145–181 respectively. These approaches have evolved from and beyond the mutual connection of 'ecology', 'economy', and 'mentality' which now classic pioneering American environmental historians postulated in the 1980s (McEvoy, "Interactive theory of nature and culture," and Worster, "Doing environmental history" in *Ends of the Earth*, 289–307).

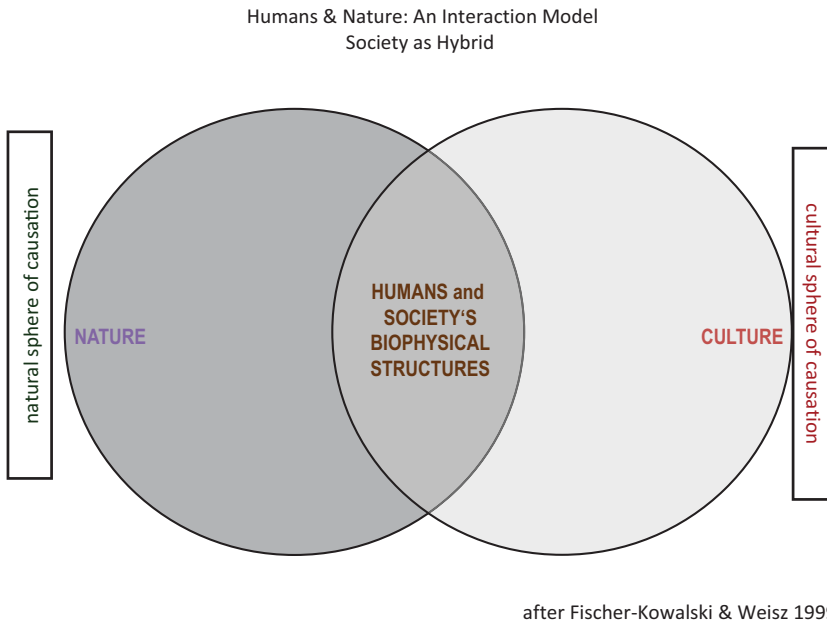

Figure I.1 Humans and Nature: an interaction model – society as hybrid.

to their surroundings in networks now called ecosystems. For each living thing, those flows constitute its metabolism. Humans and their societies have metabolisms, too.

In terms articulated by a group of social ecologists in Vienna, the realms of culture and nature *interact* in the actual world. Human bodies, artifacts, and societies necessarily function as *hybrids* of nature and culture, possessing both symbolic and material attributes. Figure I.1 attempts to visualize this condition. Material actions of humans are subject to natural forces, while the realm of nature enters human perceptions only through cultural forms, notably language. When, however, humans interact with the natural world, they modify it, intentionally, knowingly, or not. Changed flows of materials and energy result in new ecosystems, not purely natural but 'colonized' for human cultural purposes (Figure I.2). Yet in even the most humanized of circumstances, natural forces remain, sometimes giving human interventions *un*intended results. Our fish tales have already illustrated this.

Two further aspects of this interactive or metabolic perspective help organize data and thinking in environmental history in general and about

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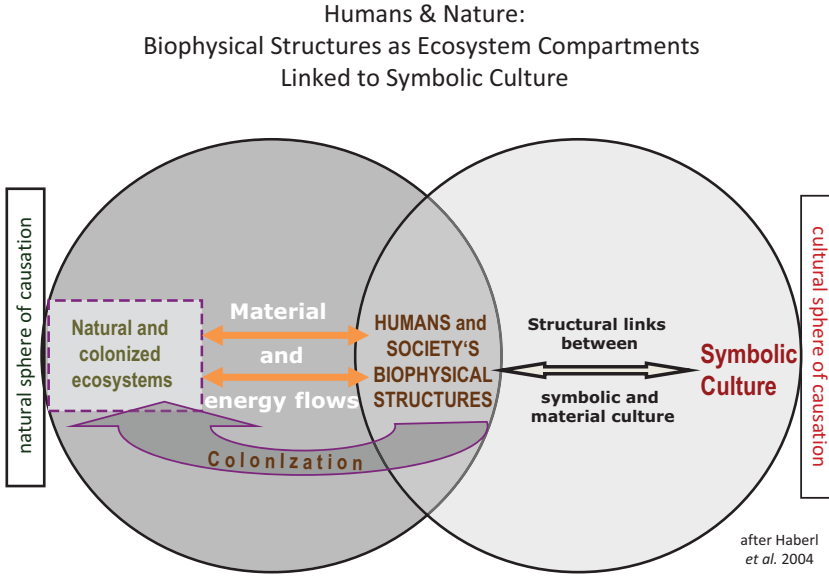

Figure I.2 Humans and Nature: biophysical structures as ecosystem compartments linked to symbolic culture.

medieval fisheries in particular. First, relations between the natural and the cultural spheres are *reciprocal* and cumulative, driving but not determining change in both realms (Figure I.3). When people experience their physical environment, they make sense of this experience as a cultural representation, which then becomes an object of processes within the cultural sphere. So long as those processes remain symbolic, even if they become coherent programs to do something in material life (such as make a net to catch fish or erect a temple), they lack environmental effect. Whether driven by moral values or what might be called economic concerns, cultural programs enter the natural sphere through human physical work, which both changes and is itself subject to the natural sphere. Subsequent human experience with this new colonized nature (the net catches fish but destroys habitat, so driving other fish away; the new cathedral removes large trees for miles around) results in new representations. Over time nature and culture co-adapt, resulting in the *co-evolution* of both.

Second, it is soon apparent that the heuristics of 'Nature' and 'Culture' are themselves cultural constructs, generalized concepts free from time and space, by which we try to make sense of our experiences. What rather occurs in a 'real' world of human behaviour is that (potentially) identifiable

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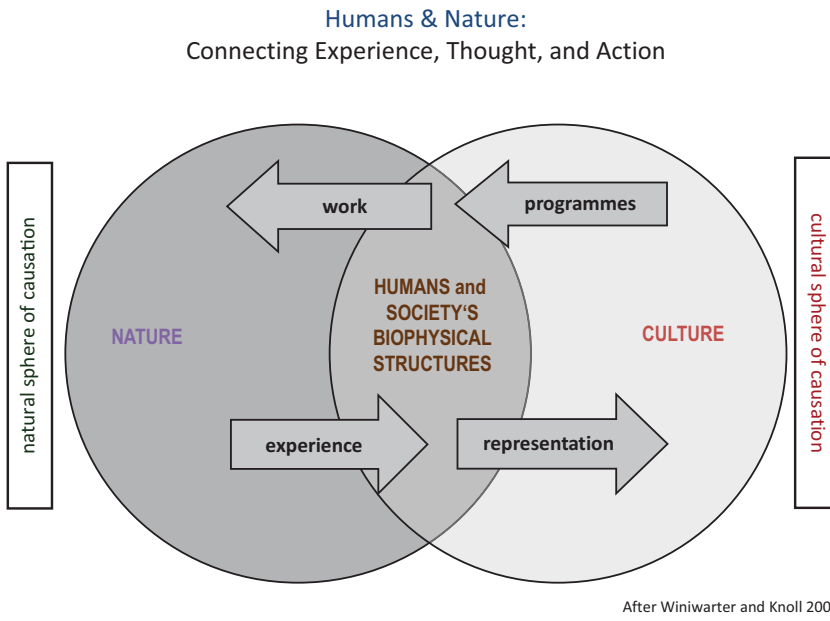

Figure I.3 Humans and Nature: connecting experience, thought, and action.

individuals or groups with specific culturally defined purposes and practices pursue these in specific places with their own natural features: a Genoese fisher setting out to catch sardines in the Tyrrhenian Sea is not the same as a Swedish miller with salmon traps in the mill leet. The 'hybridity' and 'co-adaptation' of theory are thus but labels for what people and some things of nature do at particular 'socio-natural sites'. Historians' generalizations about, for instance, the construction of weirs to take migratory salmon, shad, or eel and the effects of these structures on the runs of fish are therefore assembled from what specific men and women did at particular times on (then) identifiable reaches of the Blackwater, the Humber, the Dordogne, or Rhine, each understandable as a socio-natural site. The same applies at larger scale to the waters and shores of the Danish Øresund, where thousands of men and women assembled each summer in late medieval centuries to catch and cure herring. The concept of socio-natural sites reminds present-day historians and their readers that actions in the natural world are by individual, named, people at places with distinctive features. Medievalists can rarely see the personal side of ordinary peasants, fishers, or even seigneurs. Environmental histories often treat only policymakers or collectivities. So individuals who do appear in

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relevant sources here will often be remarked. So will the specific places engaged by those people. The abbey of Cluny and its priory of Paray le Monial are but fifty kilometers apart, each on a river in southern Burgundy draining from the Massif Central. The former sat beside the Grosne, a tributary of the Saône and thus of the Rhône, the latter on a minor affluent of the Loire. Monks or their servants at Paray could exploit migratory Atlantic salmon at their doorstep, but not so those at the mother house.

Fishing is simultaneously an ecological and a cultural (economic, symbolic, social) act. This book attempts to ascertain the people, practices, and installations intended to take fish under certain conditions from identifiable medieval waters and put those fish to human use. Even fragmentary knowledge can help establish human experiences, programs, and work with consequences for natural and social systems alike. If and when such actions and impacts reach a scale sufficient to transform an entire socio-natural site (or collectivity of such sites) into something quite different we can speak of an 'ecological revolution' or a 'regime shift'.[61] The ability of a defined system (social and ecological) to persist under such pressures is a good working definition of 'resilience'.[62] In shifting scale from site to socio-economic structures to ecological revolutions we also go from individual human experience to large collective generalizations which may lie beyond contemporary awareness.

I.2.2 Interrogating What Remains

Historians habitually borrow concepts and theories from other disciplines – supply and demand from economics, queering from sex and gender studies – to test if these ideas help them understand conditions, events, and developments in the past. Medievalists are likewise familiar with employing multiple tools to squeeze meaning from scattered and skewed fragments from a largely illiterate and long-gone culture. The inherent interdisciplinarity of environmental history was already manifest in introductory fish tales, where use of saint's legends might surprise fisheries ecologists, references to ancient DNA and water chemistry may have caused some medievalists to blink, and ecological concepts lent meaning to data. Environmental history often ranges widely not only for concepts but for empirical methods to obtain critically credible data about the past.

[61] Merchant, "Theoretical Structure of Ecological Revolutions" and Scheffer, *Critical Transitions*, 104–105, 121–122, 186–216, and 357.
[62] Holling, "Resilience and stability," is the classic formulation.

Despite different media and sometimes analytic vocabularies, traditional history, conventional archaeology, and the zooarchaeology heavily used in this book have similar needs and ways to establish the identity of an object, its likely relationship to a particular past, and (the limits of) its ability to provide information about that past. The textual and [icono]-graphic objects [sources] commonly examined by historians and other humanist scholars were once created with some kind of communication (or memory) in mind, though sometimes a new viewpoint can reveal information other than that intended. For instance, that it took a miracle to provide Thomas Aquinas, dying in 1274 at a monastery on the road from Naples to Rome, with his desired dish of herring (transformed from sardines)[63] unknowingly provides a good sign that the widely traded Atlantic fish had not reached Italy before 1300. The hybrid quality necessarily imparted to fish from their capture through eventual consumption is obvious, and more so if marketed in the process. Records of prices thus indicate points of plausible consensus between supplier and purchaser/consumer on the value of this object at a particular time and place. At several points in this book historically retrieved fish prices serve to shed light on the relative value of different fish varieties, both biological species and forms of processing; on the value placed on fish compared to other foodstuffs, wages, or other quantitative social markers; and eventually on some changes over time in price series. Supplement I.2.2 online treats critical distinctions among sources of price citations and the constraints this places on inferences from them.

Traditional archaeologists recover material artifacts and structures, objects rarely created or deposited with communicative intent. Having, like a historian, established the character and date of the object, the archaeologist can infer the purpose and evident abilities of its makers. Patterned finds of large stones and beams in what once were river gravels can indicate a fish trap and, if enough of the structure is recovered, its orientation in the flow shows whether upstream migrant salmon and shad or downstream migrant adult eel were the quarry. The structure alone neither identifies the builders or operators nor reveals when it was used (but see below).

Zooarchaeologists work with what some call 'ecofacts', pieces of the natural world modified and commonly deposited by humans. In the present context this means fish bones which a skilled analyst can identify to the level of family, genus, or species. An individual bone may indicate

[63] As reported by the first hagiographer of Thomas and principal investigator for his canonization in 1323, Guillaume de Tocco, in *Ystoria sancti Thome de Aquino*, 192–194 (ch. LVI).

the animal's presence and likely ecological origin – preferred habitat, range, etc. – but say little of its sociocultural significance. An assemblage produces a calculation of relative taxonomic abundance, and perhaps a pattern in the size of fish or in the presence or absence of certain skeletal elements indicative of butchering techniques.[64] But now there comes into play what archaeozoologists call 'taphonomy', considering what happens to organisms after they die and leading to reconstructing site formation and recovery. The process is always somehow selective. While all fish bones are less durable than those of domestic mammals, those of some varieties, the salmonid family in particular, decay more rapidly and completely than do others. Large bones of large fishes are sturdier and more easily recognized than the small bones of small species. Excavation strategy becomes critical: presence of pike-perch or cod in a sample only hand-picked is convincing, but absence or low representation of eel, whitefish, or sardine says little if the context was not sieved. Yet similar critical reasoning applies to the most traditional historical sources: monastic cartularies retain the charters where the house gained, not those recording an opponent's victory. An artist's observation or convention may or may not replicate distinctive features of a fish or of a capture device. Basket traps (pot gears) are commonplace in medieval illustrations, nets shown deployed from boats rarely comprehensible, and major barrier traps simply invisible.

In words of archaeozoologist László Bartosiewicz, "It [taphonomy] may be seen as the common denominator between archaeological, iconographic and textual data within the context of reconstructing life during the Middle Ages."[65] Taphonomy provides a paradigm for systematic analysis of selective and differential loss and preservation/recovery of remains from the medieval past and hence, whatever the discipline associated with a particular medium, the variety of source materials comprising the historical record for medieval Europe. This book follows such a holistic critical approach to evidence of people and fish.

Finally, the practice of environmental history in the early twenty-first century draws increasingly on findings from palaeosciences, recovering information about the past from materials and features outside any realm of past human awareness or purpose. In certain circumstances those recovered logs from fish traps are datable by analysis of tree rings and/or radiocarbon. Certain stable isotopes extracted from collagen in fish

[64] Orton, "Archaeology as a tool for understanding," provides a useful summary catalog of zooarchaeological evidence for historical ecology, including some of the palaeoscientific methods discussed below.

[65] Bartosiewicz, "Like a headless chicken," 21.

remains can indicate the region where the fish were taken – so far notably to discriminate among cod bones of Baltic, North Sea, Norwegian, or New World origin.[66] Other stable isotopes in protein from human skeletal remains can signal significant consumption of marine organisms during at least the last decades of the individual's life. Marine sediments provide proxy indicators for water temperature and datable river deposits for pollution by heavy metals. Most of what is now known about climate and its changes in Europe's medieval millennium comes not only from textual references to weather but from tree rings and from isotopes and volcanic ash in ice cores from glaciers and sediment cores from deep seas and lakes.

The operative mode of enquiry underlying this book is shared among disciplines, namely critical assessment of relations between specific relics of the past and the way each has reached the present. Historical texts call for source criticism, archaeological materials for taphonomic analysis, and palaeosciences for the processes and calibrations which make certain observations convincing proxies for past environmental conditions. All procedures ask what statements regarding a specific past this data can support, which it would negate, and where it is mute. Just as failure to sieve means no information about consumption of small fish, lack of literate interest in techniques of capture does not mean none were being used. The goal is consilience, a concordance of evidence from independent, unrelated sources, or good reasons for its absence.[67]

A further epistemological problem is negotiating matters of scale. How to get from an individual set of market regulations, the archaeological context of a single bone-filled kitchen midden, or an individual socio-natural site to infer cultural norms, trends, or the historic range of a fish species? Truly quantitative or quantifiable source materials and comparative methods have limited applicability for the Middle Ages. In what follows, this issue shall call for documenting multiple cases and variants across spaces and/or times: authorities labeled fish traps hazards to navigation in the sixth-century Po, thirteenth-century Thames, and fifteenth-century Danube; in one early medieval site after another across Europe all the fish identified, though of different species, ranges, and habitats, were recognizably native to nearby waters. Beyond hopefully representative examples in the text, more often appear in the online Supplement. *The Catch* thus aims to piece together fragments of information to reveal what

[66] Barrett et al., "Interpreting the expansion."

[67] Izdebski et al., "Realising consilience"; Newfield and Labuhn, "Realizing consilience"; and Haldon et al., "History meets palaeoscience," apply Wilson's classic *Consilience* to research on medieval environments.

medieval people said, what they seemed to know and do without telling, and what those contemporary witnesses could neither know nor comprehend about their encounters with Europe's aquatic life. Of course when even present-day environmental consequences seem to hover at the edge of human awareness, none should be surprised to find here occasionally hypothetical reconstruction from an exiguous and commonly unplanned medieval record. Scraps of historical information are patterned by known ecological relationships and processes or by known cultural mechanisms linking extraction of fish from their habitats and distribution to people who ate them.

A well-conceived environmental history offers perspective in time for current dilemmas and responses. It can sustain this first comprehensive interpretation of preindustrial European fisheries from an environmental and not simply economic point of view. It further recognizes the dynamism and resilience of the non-human in shaping the long-term encounter of aquatic nature and medieval Europeans. This permits historically and biologically knowledgeable tracing of antecedents for a present environmental crisis back before the most recent centuries and to roots of dominant paradigms for market-based development and resistance to it.

I.3 Then and Now and Then

Tales of medieval sturgeon and cod eventually fit into a present narrative of crises in aquatic systems and thus the human communities entwined with them. A generation and more of scientific research has broadly identified a global 'fisheries crisis' and richly exemplified its diverse local aspects, only some of which our fish tales have highlighted. More than four in five stocks are now assessed as fully exploited, overexploited, or depleted. From an ecological perspective, especially noteworthy is the depletion by an estimated 90 percent of large predatory fish populations, the top of the food chain, in all the world's oceans.[68] Effects cascade down entire ecosystems. Biodiversity and natural ecosystemic interactions are put at risk by depletion, pollution, habitat destruction, and invasive species. Rising global temperatures draw attention to strong scientific research findings that climatic fluctuations and changes do cause and have caused large-scale changes in fisheries at both short and

[68] McNeill, *Something New under the Sun*, 243–252 and 257–260, surveys the present crisis. For quantitative perspectives see Worm and Branch, "The future of fish," 594–599, and FAO, *State of World Fisheries 2014*, p. 3. Smil, *Harvesting the Biosphere*, 206–210 and 212–214, critiques such estimates. An adeptly contextualized historical overview of destructive modern commercial fisheries is Simmons, *Global Environmental History*, 139–41 and 193–94.

long term, especially under conditions of heavy human exploitation and/or for species near the limits of their range.[69]

Proposed remedies for particular and global fisheries crises are not lacking, though all pose proven or potential economic, cultural, and ecological risks. The very regulatory regimes meant to conserve wild stocks and protect their habitats have been blamed for the collapse of bottom fisheries in both the Canadian and American Atlantic. The relative conservation value of community control or privatization of aquatic resources is fiercely debated. Environmentalists, local fishing communities, and large fisheries corporations hold different views on the value and effects of establishing large protected areas or aquacultures. Environmental manipulation always seems to have a 'catch', a collateral or unanticipated consequence. Today's acute and pressing problems of humans and fish around the world frame this book's investigation. The millennial history of medieval European fisheries offers long and well-documented parallels, examples, and warnings for present-day concerns. But "the past is a foreign country, they do things differently there."[70] Fishers, fisheries scientists, managers, and conservationists need translators to understand what interdisciplinary visitors might there see, hear, or read. For a millennium of the European experience, medievalists must assume that role – if, when it comes to fisheries, they know the terrain and can read the water.

[69] Sample case studies and big data in Aarts et al., "Habitat loss"; Airoldi and Beck, "Coastal marine habitats"; Tockner et al., *Rivers of Europe*, *passim*; von der Ohe et al., "Water quality indices across Europe," 970–978; Humphries and Winemiller, "Historical impacts on river fauna"; Lassalle et al., "Diadromous fish conservation"; Allison et al., "Vulnerability of national economies to the impacts of climate change on fisheries," 173–196; Dulvy et al., "Climate change and deepening of the North Sea fish assemblage"; Brander, "Impacts of climate change"; Smil, *Harvesting the Biosphere*, 246.

[70] A phrase shameless historians borrow from novelist Leslie P. Hartley, *The Go-Between*, 1.