Local-level management and the commons problem

A comparative study of Turkish coastal fisheries

Fikret Berkes

There are several distinct sectors in the Aegean and Mediterranean fisheries of Turkey, including the inshore small-scale fishery, trawlers, purse-seiners and beach-seiners. Each of these sectors may be characterized in terms of their levels of catch, fuel use and investment. Local-level arrangements and rules for the allocation and management of fish resources exist in some of the small-scale fisheries, constituting a kind of 'informal law of the sea' for regulating access to the resource. These rules work well when the resource is being used by one relatively small and homogeneous group of users. In such cases, local-level mechanisms may provide a feasible set of institutional arrangements for the sustainable management of some coastal fisheries.

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In many countries of the world fishery resources are legally defined as common property and open-access. However, experience with many fish stocks over the decades has shown that open-access management of fishery resources does not work once the fishing capacity of the fleet approaches or exceeds the ability of the stock to sustain it. Failing fisheries throughout the world have been characterized by declining total yields, sharp decreases in the yield per unit of fishing effort (for example, harvest per boat of standard size), the disappearance of the more highly valued species, cut-throat competition among fishermen, and in some cases the economic collapse of the fishing industry.[1]

Ocean resources are often called the 'common heritage of mankind', a global common property resource. Eckert has analysed the emerging ocean management regime as an attempt to establish property rights over marine resources, a kind of 'enclosure' movement. Thus, the 200-mile extended economic zone (EEZ) and extended fisheries jurisdiction (EFJ) have been seen as steps towards the process of privatization of ocean resources. Eckert observes that the holders of exclusive rights would have strong incentives to reduce the inefficiencies associated with the collective ownership of resources. However, the new international order does not automatically guarantee improved allocation. Rather, it only offers 'greater opportunities for such improvements'.[2]

The initial years of the extended fisheries jurisdiction have not produced the anticipated fishery benefits to coastal communities of fishermen. There are a great many examples throughout the world of conflict within national fisheries, overcapitalization, and continuing loss of resources due to overfishing. In particular, there have been conflicts between the offshore and the inshore fisheries sectors, and among

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nities Research Council of Canada (SSHRC).

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[1]Examples may be found in any recent fishery text, eg C.W. Clark, *Bioeconomic Modelling and Fisheries Management*, Wiley, New York, 1985.
[2]R.D. Eckert, *The Enclosure of Ocean Resources*, Hoover Institution Press, Stanford, 1979.
[3]P.S. Dasgupta, *The Control of Resources*, Harvard University Press, Cambridge; D. Thomson, 'Conflict within the fishing industry', *ICLARM Newsletter*, Vol 3, 1980, pp 3–4.
[4]The term 'commons problem' is used here in the same sense as the 'tragedy of the commons' of G. Hardin, 'The tragedy of the commons', *Science*, Vol 162, 1968, pp 1243–1248.
[5]The terminology follows Bromley who considers that there are four alternative management regimes for common property (or common pool) resources: (1) open-access, (2) common-property, (3) private property, and (4) state property regimes. Some authors (eg E. Ostrom) refer to shared resources such as fisheries as 'common pool resources' in an attempt to avoid the confusion of terminology between the *resource* and the *regime*. D.W. Bromley, 'Closing comments', *Common Property Resource Management Conference*, National Research Council/National Academy of Sciences, Washington, DC, 1985; E. Ostrom, 'Issues of definition and theory: Some conclusions and hypotheses', *Common Property Resource Management Conference*, National Research Council/National Academy of Sciences, Washington, DC, 1985.
[6]B.J. McCay and J.M. Acheson, eds, *Capturing the Commons*, University of Arizona Press, in press; F. Berkes, 'Fishermen and

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user-groups of resources in certain areas.[3] In some cases these conflicts existed before the new ocean regime. But in other cases, they have been exacerbated by the development of national offshore fleets in anticipation of the increased fishery benefits as a result of the extended fishery jurisdiction.

The new international ocean regime is best designed to solve the international common property resource problem (henceforth the 'commons problem').[4] It may assist in the solution of the commons problem within the national jurisdiction by enabling the assignment of exclusive and transferable private property rights to individuals and firms. Many fishery scientists and administrators see privatization as, ultimately, the only solution to the commons problem because it seems to repudiate the possibility of workable communal arrangements for resource use and allocation.

Many researchers have independently discovered over the years various types of local arrangements which constitute a kind of 'informal law of the sea'. Many freshwater and coastal marine stocks of fish are not exploited on an open-access basis. Rather, the community regulates access to the resource. Some of these findings are finally being synthesized.[6] In contrast to open-ocean fisheries which tend to be large-scale, these coastal fisheries are often small scale and community-based. While open-ocean, large-scale fisheries usually come under national and international levels of management, the small-scale coastal fisheries often operate outside the framework of measures instituted by central governments.[7] Open-ocean fisheries may be best characterized as 'unowned resources' or *res nullius* (at least until recently). By contrast, coastal fisheries may be best characterized as being owned in common or *res communes*, according to Ciriacy-Wantrup and Bishop's definition of common property.[8] Far from being 'everybody's property', common property means that 'potential resource users who are not members of a group of co-equal owners are excluded.'[9]

None of the fisheries in the study area (Figure 1) are really large scale by international standards, or even by the standards of the Turkish Black Sea where the bulk of the Turkish catch is landed. However, some of the fisheries are large scale and community-based, while others are not. The first task of the paper is to describe and characterize the different kinds of fisheries in the study area. Secondly, evidence will be presented for local-level management and for the existence of common property institutions. The focus is on small-scale fisheries and their

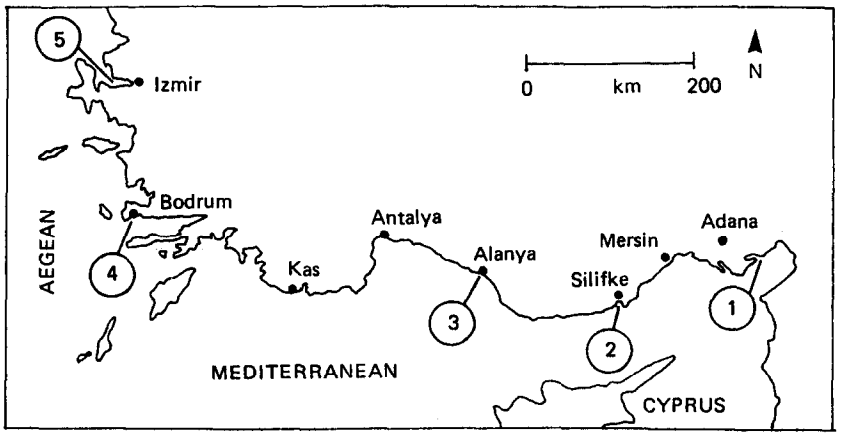

Figure 1. The study area, (1) Ayvalik-Haylazli lagoon fishery, (2) Taşucu, (3) Alanya, (4) Bodrum, and (5) bay of Izmir.

conflicts with the larger-scale fisheries and other user groups, leading to an investigation of how conflicts affect the emergence and persistence of common property institutions that regulate the use of the resource. Thirdly, these findings will be discussed from the point of view of their significance for fishery development policies.

Types of fishing operations in Turkish coastal waters

Fisheries in the southern seas of Turkey share a number of characteristics: they operate in biologically-poor waters and preferentially utilize a diversity of bottom-dwelling species which are of limited abundance but relatively high market value.[10] There are basically four kinds of fishing operations in the Aegean and Mediterranean waters of Turkey.[11] By far the largest numbers of fishermen are employed in the small-scale fishery sector. A typical two-man operation uses an 8-m open boat with a 10–25 HP inboard diesel engine. The larger units may use 10-m boats with three fishermen. A few are equipped with depth-recorder/fish-finders. The vessel design varies from region to region, all traceable to sail and row boats as used prior to mechanization in the 1950s. Most fishermen use two basic gears, trammel nets and longlines. Trammel nets are modified gillnets set on the bottom within the shelf area; they catch fish by entanglement. Depending on the area, fishermen use different meshes of trammel nets, usually one small-mesh net for small species such as red mullet, and one large-mesh net for others. Longlines consist of a series of baited hooks on a main line attached to a float. Both of these two types of equipment are used in exploiting a diverse fauna of demersal (bottom-living) species dominated by sea breams, basses, mullets, groupers and snappers. Boats normally return to home ports within a day, and the catch is marketed locally.

The larger-scale operations include trawlers, purse seiners and beach seiners. Aegean–Mediterranean trawlers are 15–25-m wooden boats of a schooner-type design, with a usual crew complement of seven or eight. Trawlers drag a bag-shaped net equipped with otter-boards and catch demersal fish. By law, trawlers are not allowed in bays and in the area within three miles of the coast, but this has been difficult to enforce. In contrast to the small-scale sector, trawlers are not restricted to waters in the immediate area of the fishing community but range up and down the coast, sometimes spending months away from home port.

Most purse-seine boats and fishermen are not indigenous to the Aegean–Mediterranean area. They come from the Black Sea and the Sea of Marmara where the catch is dominated by pelagic (near-surface) fish. Purse-seiners use a long net that hangs vertically from the surface by its attached floats. The net is pulled in a circle to enclose schools of fish and then the bottom of the net is closed off like a purse. Purse-seine boats in the Izmir area average 15 m and carry a crew of ten. They are usually equipped with radio and echo-sounders. A larger purse-seiner may be 22 m with a crew of 16, comparable to those in the Black Sea area. Such boats range up and down the coast, followed by a refrigerated truck belonging to the company. When a large catch is made, the truck meets the boat at the nearest harbour, and the fish may be sold by the owner in the company's head office to wholesalers in the large centres – even before it is loaded off the boat.

Beach-seiners are medium-sized (10–15-m) boats with a usual crew complement of five. They drag beach-seines by means of a motor winch

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the tragedy of the commons', *Environmental Conservation,* Vol 12, 1985, pp 199–206.

[7]Japan is one prominent fishing nation in which the coastal fishery is not legally defined as open-access common property, rather, there is a system of common fishing rights largely vested in local fishing associations. See Y. Asada, Y. Hirasawa and F. Nagasaki, 'Fishery management in Japan', *FAO Fisheries Technical Paper* No 238, 1983.

[8]S.V. Ciriacy-Wantrup and R.C. Bishop, 'Common property as a concept in natural resources policy', *Natural Resources Journal,* Vol 15, 1975, pp 713–727. There is disagreement over the definition of the term, 'common property resources'. Some authors define it as resources to which access is both free and open.

[9]*Ibid,* p 715. There is a wealth of case studies, especially from the Pacific region, to illustrate the concept that common property is not 'everybody's property', and that the local community often regulates access to the resources. See K. Ruddle and T. Akimichi, eds, *Maritime Institutions in the Western Pacific,* National Musuem of Ethnology, Osaka, 1984; K. Ruddle, and R.E. Johannes, eds, *The Traditional Knowledge and Management of Coastal Systems in Asia and the Pacific,* Unesco, Jakarta, 1985.

[10]The Mediterranean is an oligotrophic marine environment in which the low level of nutrients in the water is translated through the food web into low levels of fish productivity. See J.A. Guland, *The Fish Resources of the Ocean, C. Mediterranean and Black Sea,* FAO, Rome, 1971. The Aegean–Mediterranean regions have usually contributed only about 5% of the total Turkish fish harvest. Most of the rest is landed in the eastern Black Sea region, a biologically productive area dominated by schooling pelagic species, such as the anchovy. See *Su Ürünleri ve Su Ürünleri Sanayii,* T.C. Başbakanlik Devlet Planlama Teşkilati, Yayin No 1989/308, 1985, Ankara, (*Fishery Resources and the Fishing Industry,* Government of Turkey, State Planning Agency, Publication No 1989/308, 1985, Ankara. (In Turkish.)

[11]The research reported here is based on a survey of some 50 fishing communities in Turkey, 1976–78. More in-depth studies were undertaken subsequently in the five areas indicated in Figure 1. Data were gathered by open-ended interviews of individual fishermen, small group discussions, participant observation techniques, review of official documents and government statistics, landings records of fisheries cooperatives, and from a few academic studies available for the area.

while anchored in shallow areas. They are a mechanized version of hand-pulled small beach-seines still found in some areas. Beach-seiners utilize a mix of species, including some inshore pelagic species, but the catch is usually dominated by demersal species. They tend to operate near the home port, but usually range farther than those in the small-fishery sector.

In addition to these four sectors, there are different types of sport or semi-professional fishermen. In rural areas there are dynamite fishermen (an illegal practice), and other unlicensed part-time fishermen. Others may be wage earners (especially the lower income bracket civil servants) who supplement their earnings and diet by fishing occasionally. These fishermen use a variety of craft, some mechanized and some not, and are not represented in the statistics cited in this paper.[12]

Profiling the different kinds of fishing operations

Table 1 provides a summary of some basic characteristics of small-scale inshore, trawling and purse-seining operations which respect to yields, fuel use and capitalization.[13] The use of these three parameters follows the work of Thomson.[14] The small-scale inshore fishery harvests a minimum of 1 ton/boat/year and a maximum of 5 tons/boat/year. The overall average yield is estimated at about 3 tons per two-man boat (20 kg/day × 150 days/year). Trawlers covered by the survey harvested 8 to 22 tons/boat/year, averaging about 15 tons. Most of these were operating in the Mersin area and concentrating on high-value species such as shrimp.[15] Some ten years previously, catches used to be higher and consisted of demersal fish species also sought by the small-scale fishery. But these stocks, such as those around Bodrum, had declined, and the trawlers had been forced off the area as a result of the tighter enforcement of the three-mile limit. The smaller (ten-man) purse-seiners typically obtained 150 kg/day or 30 tons/year in the Izmir area.

Fuel used for the small-scale operations was typically in the area of 10 litre/day or 1.5 tons/boat/year. Trawling, a more energy-intensive kind of operation, used 67 tons/boat/year. By contrast, purse-seiners (which do not drag a net) were estimated to use 25 tons/boat/year. In terms of capitalization, the total investment of a two-man small-scale operation (boat, engine, gear) was about US$4 000 or $2 000 per man (at the 1983 exchange rate of 250 TL = US$1). The investment of trawlers varied between $80 000 and $160 000, and averaged about $17 000 per fishing job created. For ten-man seiners with one seine net, the investment was about $32 000 or $3 200 per man.

Table 1. Yield fuel use and investment characteristics of small-boat fisheries, trawlers and purse-seiners in the Turkish Aegean–Mediterranean.

	Small-boat	Trawler	Seiner
Fish yields, tons/year			
per boat	3	15	30
per fisherman	1.5	2.1	3
Fuel use, tons/year			
per boat	1.5	67	25
per fisherman	0.75	9.6	2.5
Fish yield per ton of fuel consumed	2.0	0.2	1.2
Investment, US$			
per boat	4 000	120 000	32 000
per fishing job created	2 000	17 000	3 200

[12]The licensing of commercial fishermen is stipulated under the *Aquatic Resources Act* No 1380 of 1971 (1380 Sayili *Su Ürünleri Kanunu*), which is summarized in F. Berkes, 'Marine inshore fishery management in Turkey: Some examples, problems and prospects', Common Property Resource Management Conference, National Research Council/National Academy of Sciences, Washignton, DC, 1985.

[13]These data have been compiled using a variety of research techniques as outlined in Ref 11, and aggregated and averaged for a number of communities to provide some representative numbers.

[14]Thomson, *op cit*, Ref 4; D.B. Thomson 'Fishermen and fisheries management', Expert consultation on the Regulation of Fishing Effort (Fishing Mortality), FAO, Rome, 1983; D.B. Thomson, 'Intermediate technology and alternative energy systems for small scale fisheries', South China Fisheries Development and Cordinating Programme, FAO/UNDP, Manila, 1979.

[15]The catch levels of small boats and trawlers may be even closer than that indicated in Table 1. Bingel recorded an actual total of 2 649 kg (including 1 595 kg shrimp) landed by one Mersin area trawler over a three-month period. A small boat fishing in the same waters, same year, landed 416 kg over a two-week period. Projected over a nine-month fishing year, these numbers would suggest indentical harvests of 7 to 8 tons for both boat types. See F. Bingel, 'Erdemli-Içel Bölgesi balikçiligi geliştirme projesi kesin raporu', DPT/ODTÜ Deniz Araştirma Enstitüsü, 1981. (In Turkish.)

The above analysis may provide a good overview of landings, fuel use and capitalization, but an incomplete analysis of the economics of the three kinds of fishing operations. This is because the market price for the fish varies by species. In general, pelagic species such as sardines and mackerels are of relatively low value, and demersal species are of high value. Shrimps, which were sought by most of the trawlers in the survey, brought in two to three times as much as the first and second quality demersal fish.

Ideally, therefore, information is needed on the landed value of the catch in the same units as in Table 1. Since the actual incomes are difficult to investigate, data were collected on 'typical' daily operating expenses and the 'break-even point'. The latter refers to the daily landed value level below which the fisherman (or captain) considers he is not making money.[16]

Table 2 provides a summary of the daily average expenses and the break-even point of the three kinds of fishing operations. The information on expenses highlights the contrast between the small-scale fishery and the trawler, with the seiner falling in between. The ratio of expenses to the break-even point is about 1:7 for the small-scale fishery but 1:1.7 for the trawler. Also notable, the small-scale fishery expects to gross some $40/boat/day with an average catch of some 20 kg/boat/day. This relatively high market value is typical of the Mediterranean area where the demand for fish is high relative to the supply, and where demersal species are particularly valued.[17]

Five case studies

Some marine fisheries are no doubt more amenable to closed-access fisheries management than are others. If the open-ocean fishery is at one extreme of a continuum, then lagoon fisheries are at the other extreme. As in many countries such as Greece[18] and Mexico,[19] Turkish lagoon fisheries are leased by the state and operated by private enterprise or cooperatives as a monopoly. Therefore, in coastal lagoon fisheries, there is a legal basis for the regulation of access to the resource.[20] Elsewhere on the Turkish coast, fisheries are legally open-access common property. Thus, the management regime of the central government is not conducive to the emergence of common property institutions or local-level management in general.

The five case studies in this paper were selected on the basis of whether they were clearly 'successful' or 'unsuccessful' fisheries. Success or lack thereof is defined in terms of evidence for overfishing and overcapitalization which are indicators of the sustainability and efficiency of the fishery. The evidence is detailed elsewhere.[21] Thus, the five

[16]He may nevertheless continue fishing if there is a reasonable expectation of a higher-than-average catch on some days. Whether the fisherman would continue also depends on such factors as whether or not he is paying off a loan, whether or not there are opportunities for alternative seasonal employment, and weather conditions.

[17]The Mediterranean fish are five times the average world price, and the Mediterranean demersal species seven times. See D. Charbonnier, 'Prospects for fisheries in the Mediterranean', *Ambio,* Vol 6, 1977, pp 374–376.

[18]G. Katsonias, 'The Messolonghi-Etolico lagoon of Greece: Socioeconomic and ecological interactions ofcooperatives and independent fishermen', in J.M. Kapetsky and G. Lasserre, eds, *Management of Coastal Lagoon Fisheries,* FAO, GFCM Studies and Reviews No 61, 1984, pp 521–528.

[19]8T.A. McGuire, 'The political economy of shrimping in the Gulf of California', *Human Organization,* Vol 42, 1983, pp 132–145.

[20]The Aquatic Resources Act gives priority to cooperatives in the leasing of lake and lagoon fisheries. Regulations for membership in the cooperative is specified by is charter.

[21]Berkes, *op cit,* Ref 12.

Table 2. Daily average expenses and the reak-even point for the fishery.

	Small-scale	Trawler[b]	Seiner
Expenses, $/day[a]	6	140	40
Break-even point, $/day	40	240	160
Ratio	1:7	1:1.7	1:4

[a]Expenses do not include the money paid to crew members. In all three kinds of operations, there are salaries but a shares system.

[b]Trawler owners or captains calculate their expenses over two-day periods, ie they usually land their fish every two days. Trawlers and seiners can of course stay at sea for longer periods, and usually do carry crushed ice for the fish. But there is a strong market demand for very fresh fish which forces them to land their fish frequently.

fishery case studies are not a random selection, nor are they meant to be representative of all Turkish coastal fisheries.

Starting from the east side of Figure 1, the first case study is the lagoon fishery of the Ayvalik-Haylazli near Adana (Figure 2). This is a successful fishery in which 103 registered fishermen (as of 1983), all belonging to three neighbouring villages, fish the lagoon and the adjacent waters as covered in their lease. All fishermen are cooperative members and all cooperative members are active fishermen. The charter of the cooperative restricts membership to those with six months of residency in one of the three villages, and to those who do not have wage employment income. The cooperative was founded in 1974 and initially included members from the outside and those who held wage employment. Subsequently, these members were given the choice of relocating in the three villages and giving up wage labour. Those who did not were expelled.[22]

The limitation of membership makes it possible to keep the cost of fishing very low. This is done by working in groups of four, using two rowboats and one motorized vessel per group. The rowboats are towed to the fishing area and the motor boat is then anchored, thus saving fuel. Each of the four fishermen have equal shares of the boats and gear, and the day's earnings are split equally. The relatively small size of the area makes it possible for the cooperative to police its fishing area. Nevertheless, the fishery is not completely conflict free. Boats from the outside occasionally come into the cooperative's area, and sport fishermen from the large city of Adana cause additional problems.

The second case study is the coastal fishery in Taşucu Bay near Silifke (Figure 3). There are 140 fishermen and 90 small inboard boats in this fishery, all from the same town and all belonging to the same cooperative. The right to fish is not restricted to members, but there are compelling reasons to join. Cooperative membership has the attractive features of a $3 000 bank credit[23] and a year-round, seasonally adjusted guaranteed price for the fish. The cooperative operates a freezer/cold storage facility to stabilize prices and to control the market. Furthermore, the cooperative sells equipment at a subsidy, and protects the bay from intrusion by trawlers.

Founded in 1968 by a local businessman-fisherman, the Taşucu Co-op is one of the best-studied producers' cooperatives in Turkey.[24] Prior to 1968, there were three rowboats, two motorized boats and a number of

[22]The chapter actually excludes from membership those who have taxable income. Small farmers, as with small fishermen, pay no income tax, and are eligible for membership. This is the only one of the five case studies in which there is a significant percentage of licensed fishermen who are part-time fishermen and part-time farmers.

[23]1983 US dollars. This is sufficient capital to cover start-up costs of a modest new fishery. Some fishermen have reportedly made enough to pay off the loan in a year. According to cooperative records, the top individual fisherman in 1982 landed 2.3 tons, and the top earner grossed $4 000 (not the same person).

[24]O. Ozankaya, *Kooperatif Kur, Sefaletten Kurtul', Turkiye 'de Kooperatifçilik,* Milliyet Yayinlari, Istanbul, 1976. (*'Start a Cooperative and Escape Poverty', Cooperatives in Turkey.* In Turkish.)

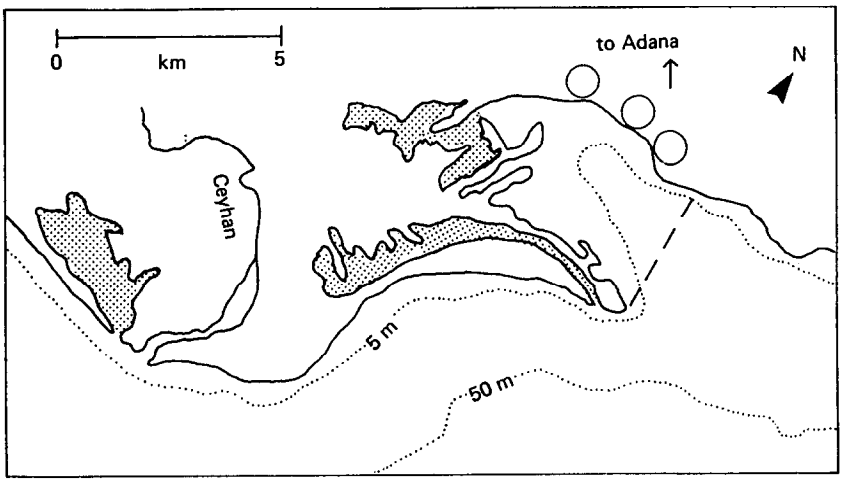

Figure 2. Ayvalik-Haylazli Co-op lagoon fishery (the most northerly of the three lagoons, stippled) and its adjacent waters (the area west of the dashed line). The three villages which operate the fishery are shown with circles.

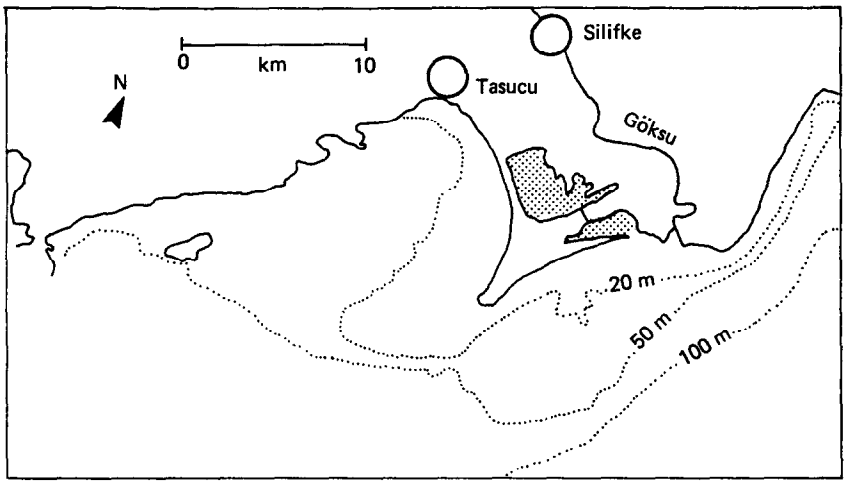

Figure 3. Taşucu Co-op operates in Taşucu Bay and the adjacent coast. A different cooperative operates the lagoons (stippled) and fishes at the mouth of lagoons and Göksu River, overlapping with the Taşucu fishery, apparently without conflict.

dynamite fishermen in Taşucu. The cooperative banned dynamite fishing in the area, and promised members the means to obtain proper fishing equipment. By 1971, cooperative members owned 40 motorboats, and were waging a battle with trawlers who operated inside the bay illegally.[25]

Compared with those in other coastal areas, Taşucu fishermen seem to be able to make a good living without fishing particularly hard. The cooperative leadership argues that the bay can probably support up to some 300 small boats – provided that destructive practices such as dynamite fishing, night fishing with SCUBA gear and trawling are controlled. New membership is encouraged to help the cooperative build an even stronger financial position and political power. The government decision in 1983 to allow shrimp trawling within the three-mile limit (except mid-April to mid-July) in the area east of Silifke is considered a serious blow to the welfare of coastal fishermen, and a threat to the sustainability of the resource base.[26]

The third case study is the coastal fishery in Alanya (Figure 4). There are about 100 registered fishermen based in this town, and they operate 45 small inboard boats. About half of the fishermen belong to the one cooperative in town; others sell to independent vendors in the town market. The right to fish is not restricted in a general sense. However, there is limited number of regularly spaced net fishing sites, and the right to fish these sites, during the season for the migratory species, is restricted to the members of 'the community of fishermen', informally

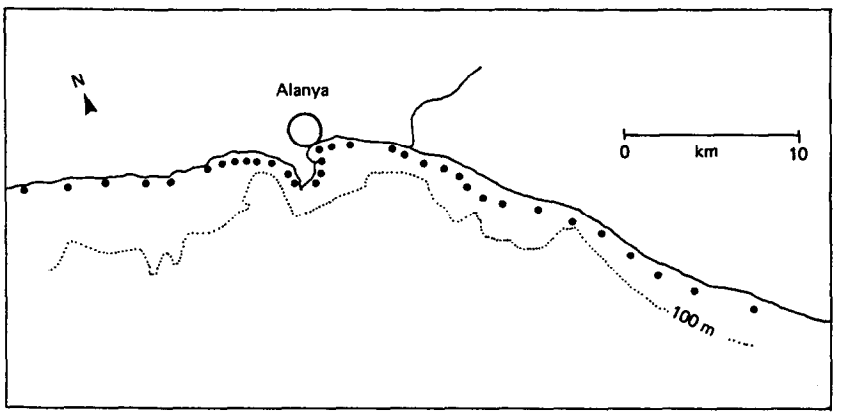

Figure 4. Alanya fishery and the netting sites used in the 1983–84 season for migratory fish.

[25]Ozankaya, *ibid.* In 1970, cooperative members actually used shotguns to chase off trawlers.

[26]The lifting of the three-mile trawl ban as a result of representation by trawlers that they are otherwise unable to make a living has been debated for some time. See *Su Ürünlerini Artirma ve Kredileri Yönlendirme Sempozyumu,* TC Ziraat Bankasi Su Ürünleri Kredileri Müd. Yayinlari No 4, Ankara, 1982. (*Symposium on Fishery Production and Fishery Investment Policies,* State Agricultural Bank, 1982, Ankara. In Turkish.) Mr. Aslan Eyce, head of the Taşucu Co-op, argues that the decision to allow inshore trawling forces a confrontation between small-scale fishermen and the trawlers. Instead of providing financial assistance to trawlers who end up 'sharing the bread of the coastal fishermen', he argues, there should be a policy to support a truly offshore fleet, with a design appropriate for that purpose. As of summer 1985, the Taşucu Co-op and two neighbouring cooperatives, with a total of some 1 000 members, were trying to have the three-mile ban reinstituted. They are up against interests representing some 100 trawlers which operate in the eastern Mediterranean coast of Turkey.

defined on the basis of willing consent. In contrast with the first two case studies, the cooperative has neither the legal authority nor the economic power to gather all of the fishermen under its umbrella. The authority of the 'community of fishermen' to make and enforce local fishing regulations is loosely based on a broad interpretation of the *Aquatic Resources Act* which states that cooperatives have jurisdiction over 'local arrangements'.

The rules are 'formalized' each year in September, at the beginning of the fishing season for migratory fish. Each fisherman who wants to participate in the fishery endorses a list of the named fishing locations, and the agreed-upon arrangement for fishing them. This serves as a contract, and is deposited with the mayor and the local gendarme.[27] Violations of the arrangement are dealt with by the fishing community at large, in the coffee house, usually by the application of social sanctions, and sometimes by the threat of violence.[28]

There is only limited conflict between the small boat fishery and other kinds of fisheries. The number of sport fishermen and spearfishing divers has been increasing. Some fishermen do in fact cater to sport fishermen and to tourists. About 25 fishing boats supplement their income by chartering to tourists in summer. An additional 38 boats, some of them operated by former fishermen, participate in the tourist trade only. There is one small trawler based in Alanya but it operates elsewhere. In any case, the shelf area is so narrow that trawlers would be discouraged.

The fourth case study is the fishery in Bodrum (Figure 1). There are some 100 small inboard boats, 11 trawlers, two purse-seiners and nine bottom-seiners based in Bodrum.[29] The traditional small-boat fishery collapsed in the 1970s after the development of the trawl fleet. With better access to lucrative markets in Izmir and with the development of Bodrum itself as a tourist centre, fishing became very profitable in the 1960s. There was only one trawler at that time. A second one was built in 1969, and one or two per year were added after that, until there were 11 trawlers in 1976. They often fished within the three-mile limit (illegally), resulting in severe conflicts with the small-boat fishery.[30]

Trawlers abandoned the area after the collapse of stocks. But this was not sufficient to revitalize the small-boat fishery because the booming tourist trade encouraged many unlicensed part-time fishermen, divers and charter boats, and created apparently insurmountable problems of user-group conflict. The local cooperative which tried in the 1970s to mediate the conflict between the small-scale fishery and the larger-scale operations had disintegrated by 1983. There are too many groups of conflicting fishermen, and no single organization could speak for all fishermen. In 1983, at least six groups could be identified:

- small-scale fishermen;
- larger-scale licensed commercial fishermen;[31]
- semi-professionals who obtained their own fish and sold the occasional surplus;
- large numbers of unskilled tourist fishermen;
- spear-fishermen licensed as sponge divers but who find fishing more profitable; and
- charter-boat operators who fish for their clients and occasionally sell the surplus.[32]

The fifth case study is the fishery in the Bay of Izmir, another area that

[27]This informal contract is not a legally-binding document, and in all probability would not or could not be enforced by the mayor and the gendarme. The reason for the authorities to go along with such an arrangement appears to be that they welcome and encourage the fishermen to solve their own internal disagreements. Otherwise, they know, they may have to cope with fights, fueds and other forms of social disorder.

[28]It should be pointed out, however, the semi-formal arrangement to close access only applies to the net fishery, in the September to May period. During most of the rest of the year, fishable stocks are scattered and there is no ecological reason to formalize rules for the use of fishing sites. As well, there are no such rules for the longline fishery for demersal species or the handline fishery for pelagic species. Nevertheless, a general rule of respect pervades through all types of fishing activities. For example, during the bonito (*Sarda sarda*) fishery in June, after the rotation system had been abandoned, the six fishermen who participated in this fishery were still spacing their nets a respectful mile or so from one another. The large-mesh, short-drift nets used in this night fishery could be counted with almost mathematical precision night after night by spotting the lanterns carried by each boat.

[29]These are 1983 figures. the actual number of licensed small-boat fishermen who make their living from fishing is very difficult to determine. Many of them appear to be partly in the tourism sector.

[30]Fieldwork undertaken in 1976 showed that small boats were lucky to land 5 kg/day, and trawlers were dumping small, unmarketable fish by the shovelful. Given the reality of daily conflict over resources, tempers became even hotter whenever a trawler cut through the set nets of small-boat fishermen in the inshore areas.

[31]Only one trawler operated in the Bodrum area in 1983; the others were in the eastern Mediterranean. One had entered the tourist trade as a charter boat.

[32]In trying to graps the complications of Bodrum fisheries, I am indebted to many non-fishermen residents, particularly, former colleague Haluk Anat.

Table 3. The number of active fishing boats in the Bay of Izmir fishery, fall/winter 1983.

Fishing Harbours	Number of small boats	Number of larger boats
1. Tuzla	30	—
2. Şemikler	100	—
3. Bostanli	75	12 purse-seiners
4. Izmir-Karataş	25	—
5. Inciralti	80	—
6. Narlidere	80	—
7. Güzelbahçe	175	15 purse-seiners
8. Urla	30	4 beach-seiners
9. Çeşmealti	80	6 beach-seiners
Total for Bay of Izmir	675	57

can be characterized as having a notably troubled fishery (Figure 5). The Bay of Izmir is similar to the case of Bodrum in that there are lucrative markets, many conflicting user-groups, and too many boats and fishermen. Table 3 provides a summary of the distribution of licensed commercial vessels.[33] With some 675 small-boat fishermen, 57 seine boats and innumerable unlicensed semi-professionals, on an average day, the Bay of Izmir probably supports well over 1 000 boats.

In contrast to Bodrum, the problem is not trawlers (none allowed in the bay). Further, there is no lack of cooperatives. There are two based in the Izmir fish market alone, one serving small fishermen and one for the larger-scale operators, plus several local cooperatives in the various fishing harbours. Each cooperative seems to represent the narrow interest of a gear type or a local group of fishermen competing for their share of the market. But none is able to tackle the larger problems of managing a crowded fishery in the proximity of a large urban centre, or protecting the collective interests of fishermen against resource degradation. The dashed line in Figure 5 marks the area closed to fishing because of pollution.[34] Further, the biologically productive marine wetlands areas along the north shore of the bay are being filled for urban development. This will no doubt further depress the fishery in the long run through the destruction of the nursery areas, the habitat of the young fish.[35]

Figure 6 provides a summary of the negative interactions among five distinct groups of fishermen:

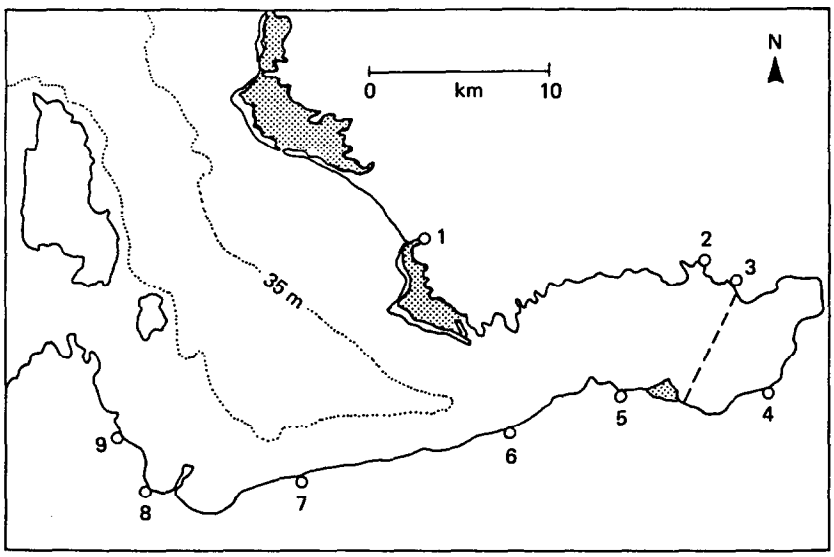

Figure 5. Bay of Izmir, major fishing harbours (as numbered in table 3), lagoons (stippled), and the area closed to fishing due to pollution (east of dashed line). The city of Izmir is to the east of the Bay, and encloses the zone in which fishing is banned.

[33]The information is largely from cooperative officials and master fishermen. I also acknowledge the assistance of colleagues at Dokuz Eylül University, Izmir.

[34]There is oil pollution in the Izmir harbour, industrial pollution of various types in the surrounding area, and eutrophication, bacterial pollution and BOD loading from untreated sewage. A total of eight ecosystem stresses has been indentified in the Bay of Izmir. See M. Kişlalioglu ve F. Berkes, *Ekoloji ve Çevre Bilimleri,* Türkiye Çevre Sorunlari Vakfi, 1985, Ankara, s 334. (*Ecology and Environmental Sciences,* Environmental Problems Foundation of Turkey, 1985, Ankara, p 334. In Turkish.)

[35]The wetland area includes productive lagoons. The largest lagoon shown in Figure 5 is the Homa lagoon which supports a fishery of 50 to 100 tons/year. See S. Cataudella et P. Ferlin, 'Aspects de basse technologie dans l'aménagement des ressources piscicoles et le développement de l'aquaculture dans les lagûnes', in J.M. Kapetsky and G. Lesserre, eds, *Management of Coastal Lagoon Fisheries,* FAO GFCM Studies and Reviews No 61, 1984, pp 567–591.

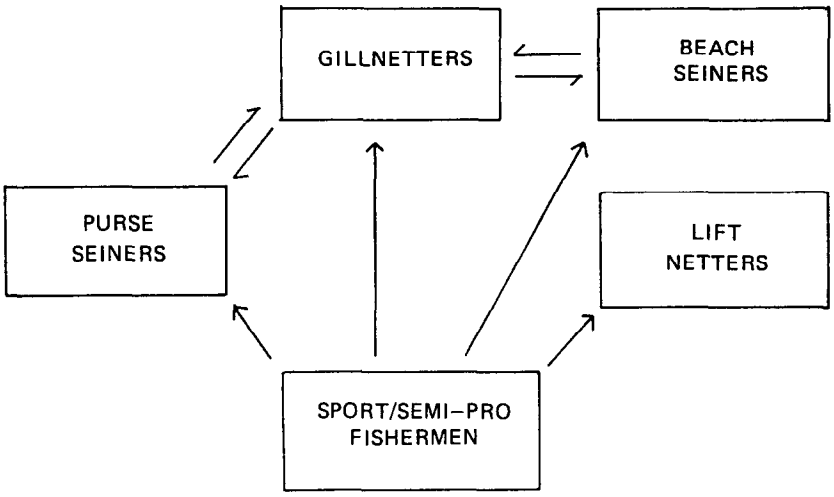

Figure 6. Five major user-groups in Bay of Izmir, and the conflicts among them.

- purse-seiners;
- small-boat gillnetters (trammel-net fishermen);
- beach-seiners;
- liftnetters;
- sport and semi-professional fishermen from metropolitan Izmir.

There are two-way conflicts between purse-seiners and gillnetters and between gillnetters and beach-seiners, basically over crowded fishing space. The appearance of liftnet fishermen as a distinct group may be explained in terms of the inability of the trammel-net fishermen to defend their untended nets. The liftnet fishermen do not set and leave the net in water to be retrieved later, but rather set and lift the net repeatedly over a wide area. Sport fishermen not only compete over scarce resources but provide nuisance by getting in the way of commercial operations.[36]

Evidence for local-level management

There is evidence of effective local-level management in the first three case studies but not in the last two.[37] Unsuccessful resource management case studies (Bodrum and Bay of Izmir) fit the conventional bioeconomic theory of fisheries rather well: an open-access fishery invites overcapitalization until the overall cost of fishing exceeds the revenue of the fleet as a whole. Resource rent dissipates and the stocks are overfished.[38] Fisheries in the first three case studies escape this fate, however, presumably because the resource is not open-access.

How this is accomplished is likely to be of interest to resource managers. As Bromley puts it, 'open-access is a free-for-all, while common property represents a well-defined set of institutional arrangements concerning who may make use of a resource, who may not make use of a resource, and the rules governing how the accepted users shall conduct themselves'.[39] In all three cases of success, there is a good understanding as to who may make use of the resource and who may not make use of it. The case is most clear in the case of the lagoon fishery where the right to fish is legally defined in terms of membership of the cooperative which has leased the lagoon fishery from the government. In the two other successful coastal fisheries, the right to fish is also defined. But this definition is rather fragile because it cannot be

[36]Some semi-professional fishermen have also attempted to introduce 'baby trawls' similar to those used in the Gulf of Mexico – Louisiana for shrimps. These were banned after complaints by commercial fishermen.

[37]Here and elsewhere in the paper, the term 'local-level management' simply refers to rules and practices which regulate access and allovate resource use rights. The use of the term does not necessarily imply a deliberate or conscious application of a conservation ethic. Nor does it necessarily imply local practices which parallel scientific fishery resource management. In many instances where local-level management exists, the fishermen are mainly optimizing their returns and minimizing conflcit within the community. To the extent that the fishermen take a long-term view of optimizing returns, local-level management may be consistent with conservation towards ecologically sustainable resource use.

[38]Clark, *op cit*, Ref 1; J.A. Gulland, *The Management of Marine Fisheries*, Scientechnica, Bristol, 1974.

[39]D.W. Bromley, 'Common property issues in international development', National Research Council, BOSTID, *Developments*, Vol 5, No 1, February 1985, pp 12–15.

formalized, and it is left to depend on inconsistently implemented regulations such as the three-mile ban for trawlers. In such cases, the success of local-level management is really outside the *control* of the local fishermen. But fishermen can and do *influence* the fishery, which is the more relevant criterion in the context of fugitive resources.

The Alanya fishery provides a particularly appropriate illustration of what Bromley calls 'the rules governing how the accepted users shall conduct themselves'.[40] The September–May fishery for migratory carangids (mainly *Lichia* spp) occurs along a narrow band of depth. Since the continental shelf falls off rapidly in this area,[41] the fish are highly concentrated at their preferred depth levels; this makes for a very productive fishery for whomever sets his nets at the right localities. Prior to 1960, there were only 15 fishermen and 15 fishing sites. However, the number of fishermen increased after that, and severe conflicts developed as fishermen cut off one another's supply of fish by placing their nets too close and crowding the better sites.

Since this kind of gear interference was affecting everyone's catch, small groups of fishermen started to cooperate by giving one another sufficient berth and then taking turns at the better sites. Over a period of some 15 years, there developed a fishing system to optimize production at the best sites, and in turn to allocate these sites by lottery, with a rotation provision to ensure that all fishermen get an equal chance to fish the best sites.[42]

At the beginning of the season, a master fisherman compiles a list of those who want to participate, and a list of the named fishing spots which are regularly spaced to minimize gear interference. Fishermen get together in the coffee house and draw lots.[43] This way, each fisherman is assigned to a fishing site. Fishermen in excess of the number of sites in rotation draw blanks. From September to January, each fisherman moves to the next site east each day. The 'excess' fishermen are rotated in, and those who hold the blanks can rest or mend nets or go longlining. After January, as the fish reverse their migration from west to east, the fishermen also reverse their movements and shift one site to the west each day, until the end of the season.

The system changes slightly from year to year, and appears to be flexible. In 1983, there were 34 sites and 37 boats. In 1985, there were 37 sites and 40 boats. Alanya fishermen are so pleased with the principle of randomized and rotational allocation of rights that small groups of fishermen set up similar systems among themselves at other times of the year. For example, 15 fishermen participating in the June fishery for *Boops boops*, a minor migratory pelagic species, were found to be using a rotation system among themselves in 1985. Boats chartering to tourists in summer also use a similar system. There is a central location for rentals, and boats strictly follow the order determined by lottery rather than competing with one another for the tourists.

The Alanya fishery provides a particularly elegant example of rules of fishing conduct, but such rules exist also in many other fisheries, even including the case studies chosen for their lack of successful management. In the Bay of Izmir, the largest beach-seine fishery is centred in Güzelbahçe (Table 3; Figure 5). These fishermen use 30 beach-seine locations to the east and six to the west towards Urla which are shared with the beach-seiners of Urla.[44] The basic rule is 'first come, first served'. There is no randomization or rotation. Conflicts still exist with other gear types and user-groups.

[40] *Ibid.*

[41] Water is 1 000 m deep at only 1 km out in some places.

[42] The development of cooperation among Alanya fishermen shows remarkably good fit with Axelrod's model for the evolution of cooperation. See R. Axelrod, *The Evolution of Cooperation*, Basic Books, New York, p 68.

[43] Dr Taghi Farvar, IUCN, Switzerland, emphasizes the pervasive importance of drawing lots in Near Eastern cultures, to randomize allocation (personal communication).

[44] Specific beach-seine fishing sites were said to exist also on the north shore of the Bay, but these were not investigated.

Effective local-level management seems to require the development of common property institutions such as that in Alanya.[45] There is no evidence in the areas studied for this paper that effective local-level management is possible without the existence of institutions and mechanisms suitable for achieving consensus among fishermen participating in the fishery. The development of such institutions, in turn, depends on the ability of the users to protect their resource base, to turn a free-access resource into one in which some limited property rights can be exercised.[46] More generally, effective local-level management requires that the users are able to control the resource base. Christy refers to this as 'territorial use rights' or TURFs.[47] A TURFs policy may be operationalized, as Thomson has suggested, by giving artisanal fishing communities exclusive control over the fishing grounds around their village.[48]

Common property institutions and user-group conflicts

There are a number of alternative explanations for 'success stories' in coastal fishery management. Previous findings suggest two hypotheses. Literature on maritime anthropology[49] and natural history[50] indicates that traditions are important. Those fishermen who have inherited detailed knowledge of the natural environment and time-tested systems for fishing have a better chance of managing their fishery successfully. Another hypothesis may be that local organizations, such as producers' associations, make self-regulation possible.[51] In the case of Turkey, the emphasis would be on fisheries cooperatives, since there is already a literature on the importance of cooperatives in the success of coastal fisheries.[52]

The case studies in this paper do not fully support these two hypotheses. One of the successful case studies, the lagoon fishery, involves almost all non-traditional fishermen. Not only the great majority learned fishing after 1974, most of them still remain committed to farming. In the case of Alanya and Taşucu, the percentage of traditional fishermen is higher, but still well under 50%. The fishing system in Alanya developed over only 15 years, presumably following five to ten years of strife. These examples do not negate the importance of traditional knowledge and institutions, but show that their existence is not an essential precondition for a successful fishery.

The relationship between fishing success and cooperatives would also have to be qualified. Both Taşucu and the lagoon fishery do seem to owe their success to their respective cooperatives. But in the case of Alanya, the common property institution supersedes the cooperative in importance. Only half of the fishermen belong to the cooperative. Nevertheless, the cooperative is used to help legitimize the fishing system which is really negotiated, not in the cooperative, but in the coffee house. The Bay of Izmir example further shows that the presence of cooperatives is not a sufficient condition for successful fisheries. There are many cooperatives, and some of them probably quite effective as marketing cooperatives and in promoting the best interests of their members. However, the commons problem in the Bay of Izmir is beyond their power.

It appears, therefore, that traditions and local organizations are neither necessary nor sufficient for the successful local-level manage-

[45]In the definition ofCiriacy-Wantrup and Bishop, the word 'property' in the term 'common property' refers to a bundle of rights in the use and transfer of natural resources. Further, 'economists are not free to use the concept 'common property resources' or 'commons' under conditions where no institutional arrangements exist'. See Ciriacy-Wantrup and Bishop, *op cit,* Ref 8, p 715; Bromley, *op cit,* Ref 39.

[46]The evolution of limited property rights in fisheries is an area of scholarly interest in its own right, and had been dealt with elsewhere. See F. Berkes, 'The common property problem and the creation of limited property rights', *Human Ecology,* Vol 13, 1985, pp 187–208.

[47]F.T. Christy, Jr, 'Territorial use rights in marine fisheries: definitions and conditions', *FAO Fisheries Technical Paper* No 227, 1982.

[48]Thomson, *op cit,* Ref 4, p 4.

[49]For a review, see J.M. Acheson, 'Anthropology of fishing', *Annual review of Anthropology,* Vol 10, 1981, pp 275–316.

[50]For an authoritative evaluation of indigenous knowledge of fish biology, see R.E. Johannes, *Words of the Lagoon: Fishing and Marine Lore in the Palau District of Micronesia,* University of California Press, Berkeley and Los Angeles, 1981.

[51]B.J. McCay, 'A fishermen's cooperative, limited: indigenous resource management in a complex society', *Anthropological Quarterly,* Vol 53, 1980, pp 29–38.

[52]Ozankaya, *op cit,* Ref 24.

ment of coastal fisheries. However, the existence of traditions and institutional arrangements such as cooperatives no doubt reduces the cost of organizing local management systems and facilitates the formation and survival of user-group organizations. One pattern that emerges from the three success cases is the use of extra-local authority, such as the cooperative charter and the local mayor or gendarme. Such 'enabling legislation' facilitates the exclusion of non-members from the utilization of the resource, and gives legitimacy to local rules for the use of the resource.

Additional explanatory hypotheses may be developed by investigating if the local group is able to control the resource, and indeed if the local group is homogeneous enough to be able to do so. Local rules seem to work relatively well when the resource in question is being used by one community of users or one fairly uniform user-group. Presumably, this reduces the 'costs' of being able to agree among themselves as to what the acceptable common rules will be. However, when there is pressure from other and different users, local rules and arrangements often break down. The appearance of a new user-group not only puts additional demands on a scarce resource, but may be instrumental in creating open-access conditions. The resource then becomes susceptible to the commons problem, and tends to be overexploited.

Ostrom summarizes the discussion on the multiple functions of the simple rule, 'you must live in this community to use this resource'. It is a rule which is easy to learn and to transmit, encourages the development of local knowledge of the resource, enhances possibilities for reciprocity, reduces decision-making costs regarding exclusion, and reduces enforcement costs.[53] It is not surprising that the requirement for local residence is a key rule in the case of the lagoon fishery, which is the only fishery that can legally make such a rule. In Taşucu, the problem is indirectly solved by making it more or less impossible for a fisherman not to belong to the local cooperative. In Alanya, the solution is at once simple and subtle. A person who wants to participate in the system has to know the named fishing sites. (Otherwise, how can he follow the fishing order and set nets in the right place?) This rule effectively closes access to those who have not served an apprenticeship in the fishery, either as hired crew or as family members or as a friend.

The size of the community of users is also important. With smaller groups, 'it should be less costly for members of the group to recognize each other, thus enhancing the ability of the group to detect rule infractions by members of the group, and entry into the commons by non-group users. The cost of decision-making and coordination of activities should similarly be related to group size.'[54] The size of the group should also permit the development of reciprocal relationships within the community of users. Axelrod's work emphasizes the critical importance of reciprocity in the evolution of cooperation.

Using the Prisoner's Dilemma game, it can be shown mathematically that if each individual plays only a single game against each opponent, the only stable strategy is to defect (ie not to cooperate).[55] Things are different, however, if individuals play repeatedly against the same opponents. Axelrod shows both formally and experimentally (by means of computer tournaments) that strategies which are 'nice' (never the first to defect), provokable (retaliates when the other side defects) and forgiving (readily returns to cooperation if the other side does so) win over strategies of non-cooperation.[56] Implications of these findings for

[53]E. Ostrom, 'The rudiments of a revised theory of the origins, survival and performance of institutions for collective action', Working paper 32, Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington, 1985.

[54]D. Feeny, 'Where do we go from here? Observations on the implications for the research agenda', in preparation.

[55]A. Rapoport, 'Applications of game theoretic concepts in biology', *Bulletin of Mathematical Biology*, Vol 47, 1985, pp 161–192.

[56]Axelrod, *op cit*, Ref 42. In the Prisoner's Dilemma game, two 'players' decide whether to cooperate or not on the basis of immediate payoffs. On first encounter, a selfish decision not to cooperate yields the highest reward for each player regardless of what the other individual does. However, if both choose not to cooperate, they are both much worse off than if both had cooperated. If the game continues for many rounds, the probability of cooperation increases. Once cooperation based on reciprocity starts, it can develop and persist, displacing uncooperative strategies.

resource management are yet to be analysed; the uses of game theoretic concepts for resource management have not been explored much.[57]

Significance for fishery development policies

It is common knowledge that most fishery development investment is directed towards large-scale fisheries.[58] Some countries have deliberately tried to reduce the small-scale fishery sector which was considered 'backward'. Perhaps more commonly, small-scale fisheries have been adversely affected as an unforeseen consequence of large-scale fishery development.[59] Much of the conflict among different groups of fishermen (eg between inshore fishermen and trawlers) throughout the world may be explained in this way. This is also the case in Turkey.

Analysing the performance of the Aegean–Mediterranean fleet of Turkey, the small-boat fishery appears to have more positive attributes than the trawl fishery, with the purse-seine fishery falling in between. On a per fisherman basis, the small-boat fishery lands almost as much as does the trawl fishery, per fisherman, while using less than one-tenth as much fuel and one-eighth as much capital for the creation of one fishing job. The policy to encourage the building of more trawlers in the 1970s, and the relaxation of the three-mile limit to accommodate them, seems to have been based on the assumption that the stocks could sustain the additional fishing effort. The collapse of Bodrum area fisheries shows clearly that this policy did not work.[60] Presently, only the high price of shrimp and the relaxation of the three-mile ban in yet another area (the eastern Mediterranean) seem to make it possible for trawlers to stay in business. This, however, may be happening at the expense of the small-scale fishery.

By contrast, the purse-seine fishery development makes sense both ecologically and economically. On a per fisherman basis, seiners land about twice as much fish as do small-boat fisheries, while using three times as much energy and 1.5 times as much capital to create one fishing job. The pelagic species they catch are worth less than the demersal fish, but, by the same token, they do not compete directly with small-boat fishermen. Even the larger seiners, capable of removing large schools of pelagic fish and fishing the entire coastline, do not seem to be considered a major threat by small-boat fishermen.

Conclusions

Local-level management provides a relevant and feasible set of institutional arrangements for managing some coastal fisheries. The three cases of success in this paper demonstrate that such arrangements can work and that there are logical reasons for suggesting that such arrangements be included among the options for management regimes for coastal fisheries. Small-scale fisheries in which the community of users is relatively homogeneous and the group size relatively small, reciprocal and mutually reinforcing relationships are feasible, thus facilitating appropriate management. Some locally-based medium-scale fisheries (such as beach-seiners) may also have this potential for local-level management. By contrast, larger-scale operations, such as trawlers, which have the capability of depleting one area and moving on elsewhere are less likely to be conducive to local-level management.

In areas where small-scale fisheries predominate, the protection of

[57]C.W. Clark, 'Bioeconomics of the ocean', *BioScience,* Vol 31, 1981, pp 231–237.

[58]J. Madeley, 'World fisheries conflict looms', *Marine Policy,* Vol 9, 1985, pp 77–78.

[59]Dasgupta, *op cit,* Ref 4; C. Bailey, 'The blue revolution: The impact of technological innovation on Third-World fisheries', *Rural Sociologists,* vol 5, 1985, pp 259–266.

[60]Overfishing by trawlers in the eastern Mediterranean was demonstrated as early as the 1950s in terms of declining levels of the catch per unit of effort. See D. Aasen and E. Akyuz, 'Some data concerning the fishery in Iskenderun Bay', Balikcilik Arastirma Merkezi Raporlari, Series in Marine Research, Vol 1, No 4, 1956, pp 1–20.

the resource use rights of these groups serves the dual purpose of minimizing conflicts, and making more likely the development of local-level management. Some major fishing nations already use this approach,[61] and others, such as Canada, are exploring it.[62] However, any policy moves in this direction run counter to age-old and cherished notions in many parts of the world that fisheries are open-access resources, and are therefore likely to be resisted.[63] The international ocean management regime, with the 200-mile extended economic zone and the extended fisheries jurisdiction, had been aptly described as an 'enclosure movement'.[64] The sustainable utilization of resources of the open-ocean demands that the commons problem at the international level be solved. But there is also a commons problem at the national level, especially right along the coastal area utilized by the largest fishery sector, the small-scale fishery. The 'informal law of the sea' devised by communities of users of coastal resources is relevant to the solution of the national commons problem. The extension of national fishing jurisdictions, converting an international commons problem to a national one, and then the extension of local-level management rights may reduce the scope of the problem to a more manageable level.[65] For offshore fish resources and larger-scale, more mobile fishing fleets, community-level management is less likely to work. In such cases, the often discussed measures for the assignment of exclusive and transferable fishing rights may indeed be more appropriate. Because of the fugitive nature of the resource, any of these alternative solutions (common property, private property or state property regimes[66]) will still be less than perfect. But this still may represent a substantial improvement over open-access regimes.

[61]Asada, Hirasawa and Nagasaki, op cit, Ref 7.
[62]C. Lamson and A.J. Hanson, eds, *Atlantic Fisheries and Coastal Communities: Fisheries Decision-making Case Studies,* Dalhousie Ocean Studies Programme, Halifax, 1984.
[63]H.A. Regier and A.P. Grima, 'Fishery resource allocation: an exploratory essay', *Canadian Journal of Fisheries and Aquatic Sciences,* Vol 42, 1985, pp 845–859.
[64]Eckert, *op cit,* Ref 2.
[65]Here and elsewhere, I am thankful to David Feeny, Department of Economics, McMaster University, for his insightful comments.
[66]Bromley, *op cit,* Ref 5.