

COUNTRY DISAGGREGATION OF CATCHES OF FORMER YUGOSLAVIA<sup>1</sup>

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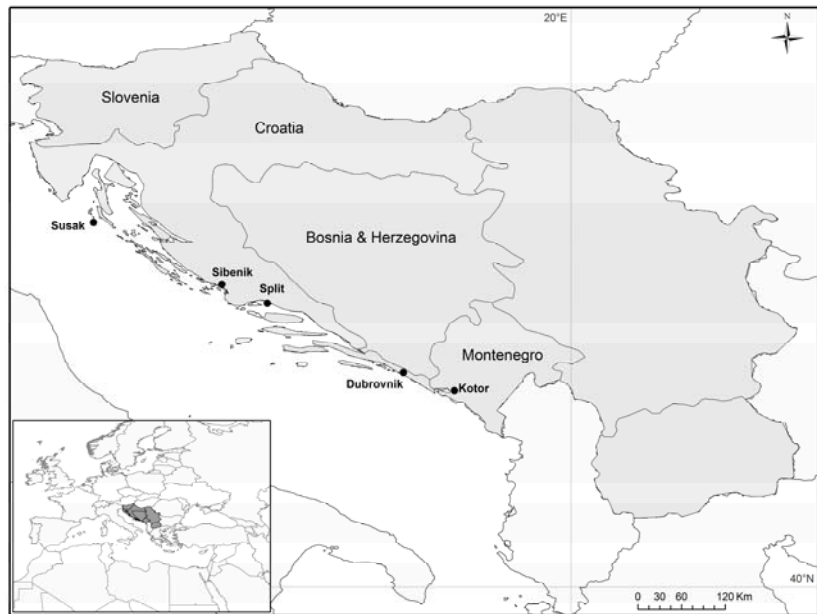
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## ABSTRACT

With the dissolution of the Federal People's Republic of Yugoslavia in the early 1990s, the fisheries catch time series data presented by FAO on behalf of its member countries consist of two sets: (1) the catch from the coast of the former Yugoslavia, reported as 'Yugoslavia (former)' from 1950-1991, and (2) the catch of the subsequently independent countries of Croatia, Slovenia, Montenegro and Bosnia-Herzegovina as independent entities since 1992. In order to better approximate the likely spatial distribution of catches along this coastline, and to streamline reporting entities, we disaggregated the reported catches from the 1950-1991 period into the spatial entities from which they likely originated, i.e., the former four republics with marine coastlines that contributed to the former Republic of Yugoslavia. This was achieved by assuming proportionality of catches (based on the average of the first five years of separate reporting) between the post- and pre-breakup period.

## INTRODUCTION

The Federal People's Republic of Yugoslavia (hereafter referred to as 'former Yugoslavia') emerged after WW II and consisted of a Federation of six Republics (Serbia, Croatia, Bosnia and Herzegovina, Macedonia, Slovenia and Montenegro, Figure 1) under a central government. The gradual dismemberment of the former Yugoslavia towards the end of the 20<sup>th</sup> century, which saw its closing act in May 2006, when Montenegro became independent of 'Serbia-Montenegro', has implications for the *Sea Around Us Project*, which aims to provide catch statistics by 'country' that are consistent over time. The most straightforward way this can be achieved is by assuming



**Figure 1.** Map of the now independent republics of the former Republic of Yugoslavia, and the key ports of Susak, Sibenik, Split, Dubrovnik and Kotor.

that 'Yugoslavia' never existed and that, instead, the six contributing republics always did. In practice, this implies retroactively re-allocating the marine fisheries catch times series of the former Yugoslavia to each of the now independent countries. Of the six republics of the former Yugoslavia, only four have coastlines

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and hence are of interest to this report: Slovenia, Croatia, Montenegro and Bosnia-Herzegovina. All have coastlines on the Adriatic Sea, which is part of the Mediterranean Sea (Figure 1).

The Adriatic is a semi-enclosed continental basin linked to the central Mediterranean at its southern end through a 72 km wide channel, the Strait of Otranto. On its western side, the Adriatic is flanked by Italy and the Apennine mountain range, and to the east are the western shores of the Balkan Peninsula. It is one of the most productive regions in the Mediterranean. The north-central sub-basins of the Adriatic are particularly productive across all trophic levels (Fonda Umani, 1996), due to both its shallow, continental nature and the high nutrient input through river outflows. It is estimated that the Po and other northern Italian rivers discharging into the Northern Adriatic supply about 20% of the nutrient input to the entire Mediterranean basin (Russo and Artegiani, 1996). The deeper, open waters of the southern Adriatic are less productive, and more typical of the Mediterranean as a whole (Fonda Umani, 1996; Russo and Artegiani, 1996).

Most resources of the Adriatic have been fished intensively for centuries. Pelagic and demersal stocks in the Adriatic are shared between the five surrounding countries. Small pelagics, in particular the European anchovy (*Engraulis encrasicolus*) and European pilchard (*Sardina pilchardus*), dominate catches and are caught by mid-water pelagic pair trawls and purse seines, the latter often using light attractions (Cingolani *et al.*, 2004a,b). The Eastern Adriatic small pelagic fishery still appears to be struggling, a result of an ongoing crisis in the fisheries sector of the countries of the former Yugoslavia (Cingolani *et al.*, 1996). Historically, sardines contributed the bulk of the catch of the Eastern Adriatic countries, and even today this species constitutes 85-90% of the marine fisheries landings of Slovenian and Croatian fisheries (Cingolani *et al.*, 2004a). Italy lands about 90% of Adriatic anchovy. Anchovy stocks declined dramatically in the late 1980s, the outcome of successive recruitment failures, and fishing and environmental pressures (Cingolani *et al.*, 1996). The stock has since partially recovered, although the current spawning stock biomass is only a fraction of the biomass before the collapse.

The bottom trawl fishery for demersal resources takes place over the entire Adriatic continental shelf. The main target species are European hake (*Merluccius merluccius*), red mullet (*Mullus barbatus*), breams (*Pagellus* spp.), whiting (*Merlangius merlangus*), anglerfish (*Lophius* spp.), flatfish (*Solea* spp.), cephalopods such as *Eledone* spp., common cuttlefish (*Sepia officinalis*), and squid (*Loligo* spp. and *Illex* spp.), as well as Norway lobster (*Nephrops norvegicus*) and deepwater rose shrimp (*Parapenaeus longirostris*) (Vrgoc *et al.*, 2004).

### *Historical development of fisheries in the former Yugoslavia*

Fisheries development on the western and eastern coasts of the Adriatic has been anomalous. Italy has one of the most developed fishing industries in the Mediterranean, including the Adriatic Sea. On the other hand, the fisheries of the Eastern Adriatic coastline are more typical of traditional Mediterranean fisheries, and consist of small-scale multipurpose vessels that mostly operate close to home-ports. In all coastal states of the former Yugoslavia, marine fisheries are technologically 'under-developed', particularly when compared with their western counterparts and despite having access to the same (fish) resources. Fishing vessels have been described as old and obsolete and fisheries are not professionally developed as other regions in the Adriatic, despite a long history of coastal fishing. The status of the fisheries sector in the countries of the former Yugoslavia may reflect the economic development of the region, which has been stifled throughout the centuries as a result of a history of foreign domination and conflicts. However, despite lacking economic importance at the national level, marine capture fisheries have been and still are very important to the coastal communities along the eastern Adriatic coast, as sources of revenue, employment, and hence social capital.

Howard *et al.* (1950) described the coastal marine and freshwater fisheries as well as fish and shellfish culture in the early 1930s in the then Kingdom of Yugoslavia (Table 1). Landings from freshwater fisheries in lakes and rivers were similar to marine landings, and included carp, pike, bream, roach, sturgeon, eels, mullets and trout. While the entire coast was exploited, the fleets were concentrated in five major districts: Susak, Sibenik, Split, Dubrovnik and Kotor (Figure 1). The fishing fleet was composed of over 6,000 vessels with a total tonnage of over 12,000 t. The total number of fishers between 1933-1939 was estimated at 19,000-29,500. Estimated yearly coastal landings from commercial fisheries between 1932 and 1939 ranged from 5,000-7,000 t. Migratory pelagic species, including sardines, anchovies, tunas and mackerels were the most important landed groups. Small pelagic landings supported a well developed coastal fish processing industry centered around Split. Small pelagics were caught using small lampara nets (lighted purse seines), while purse seining was introduced into the tuna fishery in the 1930s. Howard *et al.* (1950) also described two major forms of aquaculture: oyster mari-culture along the coast and pond culture. The

latter was introduced in Yugoslavia in the early 20<sup>th</sup> century and developed very quickly into an important industry.

After WW II, the fishing industry of the former Yugoslavia remained small; however, landings increased steadily over the decades until the late 1980s, when the demise of the Federation of Republics contributed to a sharp decline in reported fisheries catches (Figure 2).

Following is a short description of the fisheries of the now independent countries that made up the coastal areas of former Yugoslavia.

### Croatia

Croatia is the most important coastal fishing country of the former Yugoslavia (Figure 3), and is second to Italy in the Adriatic in terms of landings of capture fisheries. Marine capture fisheries in Croatia dominate the fisheries sector and are more important than the smaller, freshwater/inland fisheries sector (Fredotovic and Misura, 2003). This is no surprise, given Croatia's extensive coastline and over 1,000 islands. There are about 150 fishing ports along Croatia's rugged coastline (AdriaMed, 2000). Large-scale industrial fisheries never developed in Croatia and, for the most part, fisheries are still small-scale, coastal and seasonal (Dulcic *et al.*, 2005a). The vessels are on average around 40 years old, and have been described as obsolete and inefficient (Misura, 2002).

The 'professional' category is made up of 2,729 registered trawlers, seiners and smaller vessels that operate in the coastal and open waters of the Adriatic (Misura, 2002). The other category is the small-scale fishery in coastal waters up to a depth of 80 m. The number of licenses granted to small-scale fishers was up to 18,000 in 2004 (Dulcic *et al.*, 2005a). There is no accurate estimate of the landings arising from this fishery. However, they may be substantial given the large number of fishers involved and the high productivity of the coastal zone. An estimate of this, as yet unaccounted catch of the small-scale fisheries will be provided at a later stage.

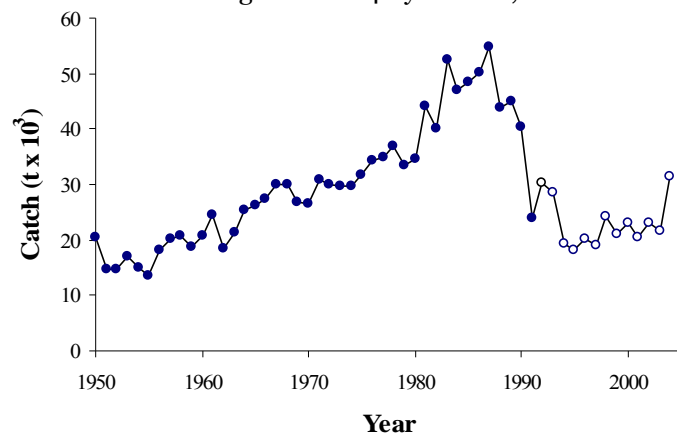
During the break-up of Yugoslavia and the ensuing violent conflicts, there was a substantial decline in the fisheries sector. The industry recovered somewhat in the 1990s, and the transition from socialist to market economy resulted in restructuring of the sector into small, privately owned enterprises (Fredotovic and Misura, 2003). The restructuring encompassed a redirection of the fishery from pelagic resources towards demersal resources which were considered to be underexploited. This led to the construction of more bottom-trawlers, until a ban was issued (Misura, 2002).

The growth in the fisheries sector slowed down after 1999, reflecting a general decreasing interest in the natural resource sectors, possibly offset by new tourism opportunities on the coast. Furthermore, average salaries for fishers are still very low and the industry is not very attractive for employment (Fredotovic and Misura, 2003). In a recent move to enhance the sector, the Croatian Government has proposed a strategy that seeks to improve fisheries management, double the aquaculture production of fish and shellfish within a decade, and revitalize the processing industry for small pelagics (Fredotovic and Misura, 2003; Marceta, 2003).

**Table 1.** Landings for Yugoslavia during the pre WW II period (i.e., 1939), showing the relative importance of species groups in the catch (adapted from Howard *et al.*, 1950).

Taxon	Landings (t)
<i>Clupea pilchardus</i> <sup>1</sup> and <i>C. papalina</i> <sup>2</sup>	2,500.00
<i>Engraulis encrasicolus</i>	79.43
Scombridae	512.81
<i>Trachurus trachurus</i>	103.50
Thynnidae	498.20
<i>Smaris alcedo</i> <sup>3</sup>	670.60
Mugillidae	204.24
Anguillidae	80.98
Crustacea	55.26
Lamellibranchiata	106.70
Cephalopoda	250.43
<b>Total</b>	<b>5,062.15</b>

<sup>1</sup> *Sardina pilchardus*. <sup>2</sup> *Sprattus sprattus sprattus*. <sup>3</sup> *Spicara smaris*

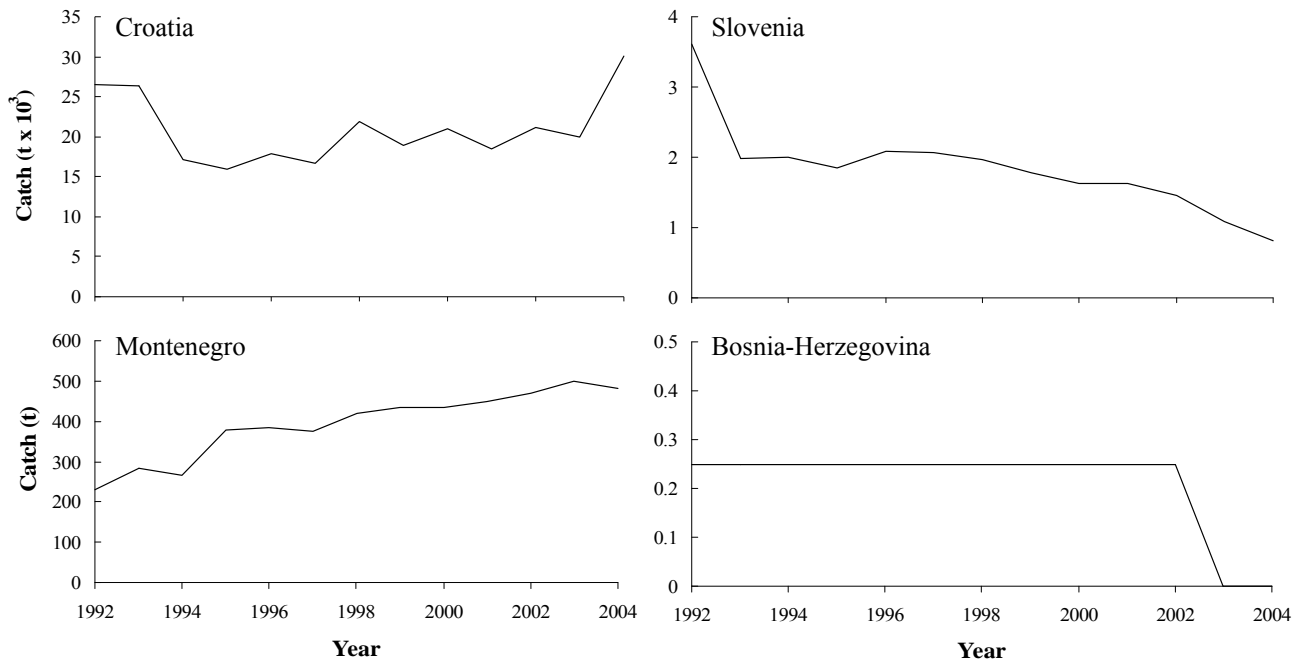


**Figure 2.** Total marine fisheries catch by the former Yugoslavia (closed circles, 1950-1991) and its component countries combined (open circles, since 1992). Data source: FAO FISHSTAT.

## Slovenia

Slovenia has a coast in the Gulf of Trieste and borders Italy to the North and Croatia to the south (Figure 1). The southern limits of the territorial waters of Slovenia are still disputed with Croatia, and bilateral negotiations to define this boundary are ongoing (Sersic, 1992).

As in the other countries of the former Yugoslavia, marine and inland capture fisheries and aquaculture are only a small part of the country's economy (AdriaMed, 2000). Slovenia has a very short coastline and, therefore, inland fisheries and aquaculture are more significant than marine capture fisheries. Despite this, and unlike other countries of former Yugoslavia, Slovenia has developed industrial fisheries that exploit both coastal (although with declining catches, see Figure 3) and offshore international waters.



**Figure 3.** Marine catch trends based on FAO FishStat for the countries of former Yugoslavia after separate country reporting commenced in 1992. The catch from Bosnia-Herzegovina was reported as  $<0.5 \text{ t}\cdot\text{year}^{-1}$ , here taken as  $0.25 \text{ t}\cdot\text{year}^{-1}$ . Note the variable Y-scale.

The official fishing vessel register for Slovenia for 2003 gives the number of vessels making up the marine fishing fleet as 100, ranging in length from 3–30 m. Registered fishing vessels include trawlers, gillnetters, purse-seiners and multi-purpose artisanal and small-scale industrial vessels. The number of small-scale vessels and their contribution to the total landings in Slovene marine fisheries is not comprehensively reported (Marceta, 2003). Pelagic fish including *Sardina pilchardus*, *Sprattus sprattus*, *Engraulis encrasicolus*, *Scomber scombrus*, *S. japonicus*, *Trachurus trachurus* and *T. mediterraneus* are predominant in the industrial catch and are caught in coastal and international waters. Demersal fish and cephalopod landings are important for the small-scale fishery. Aquaculture intensified since 1991. The species cultured are primarily European seabass *Dicentrarchus labrax* and gilt-head sea bream *Sparus aurata*.

## Montenegro

Marine fisheries in Montenegro are very small ( $< 500 \text{ t}\cdot\text{year}^{-1}$ , Figure 3), but of higher significance than inland fisheries. The number of people employed in the sector was 168 in the year 2000. Landings are composed primarily of small pelagic fish and the fishery is small-scale and not well developed. The contribution of fisheries to the country's GDP is 0.07%; hence this sector does not contribute much to the country's economy.

## Bosnia-Herzegovina

Bosnia-Herzegovina has a tiny coastline, and consequently, there is very little information available about the fisheries (mainly from [www.nationsencyclopedia.com](http://www.nationsencyclopedia.com)). There are no fishing ports and marine capture

fisheries are very small and scattered. Since independent reporting started, Bosnia-Herzegovina has reported <0.5 t·year<sup>-1</sup> (here taken as 0.25 t·year<sup>-1</sup>, Figure 3), exclusively as ‘miscellaneous marine fishes’. In contrast, there are significant landings from inland fisheries.

## MATERIALS AND METHODS

FAO reported landings (FAO Fishing Area 37, the Mediterranean and Black Sea) for marine fisheries from 1950-1991 for the former Yugoslavia were allocated to its component maritime countries: Croatia, Montenegro, Slovenia, and Bosnia-Herzegovina.

We adopted a method similar to that used to disaggregate landings for the former Soviet Union (see Zeller and Rizzo, this volume). Yugoslavia reported landings to FAO until 1991; separate reporting by its former republics commenced in 1992. As done for the former USSR, we assumed here that the distribution of landings between the four countries of the former Yugoslavia in the first few years of separate reporting reflected the proportion of total landings by each former republic prior to 1992. Thus, possible changes over time in the relative size of the fishing industry between regions were not considered.

We used landing data from FAO FishStat (FAO, 2004) from which we extracted the reported catches of marine taxa, excluding marine mammals, algae and other plants. Landings reported by FAO as <0.5 t were assumed to be 0.25 t.

For the FAO marine taxa reported by the former Yugoslavia from 1950-1991 (39 taxa from FAO Area 37), the proportion of catch  $P_{i,l}$  of taxon  $i$  to be assigned to each of the four constituent countries  $l$  was calculated as the proportion of catch  $C$  each country reported over the 1992-1996 reference period  $j$  as<sup>2</sup>:

$$P_{i,l} = \frac{\sum_{j=1992}^{j=1996} C_{i,l}}{\sum_{l=1}^{l=4} \sum_{j=1992}^{j=1996} C_{i,l}} \quad \dots 1)$$

Therefore, catch  $CT$  reported by the former Yugoslavia for year  $y$  (1950-1991) was allocated to each of the  $l$  countries as:

$$C_{i,l,y} = P_{i,l} \times CT_{i,y} \quad \dots 2)$$

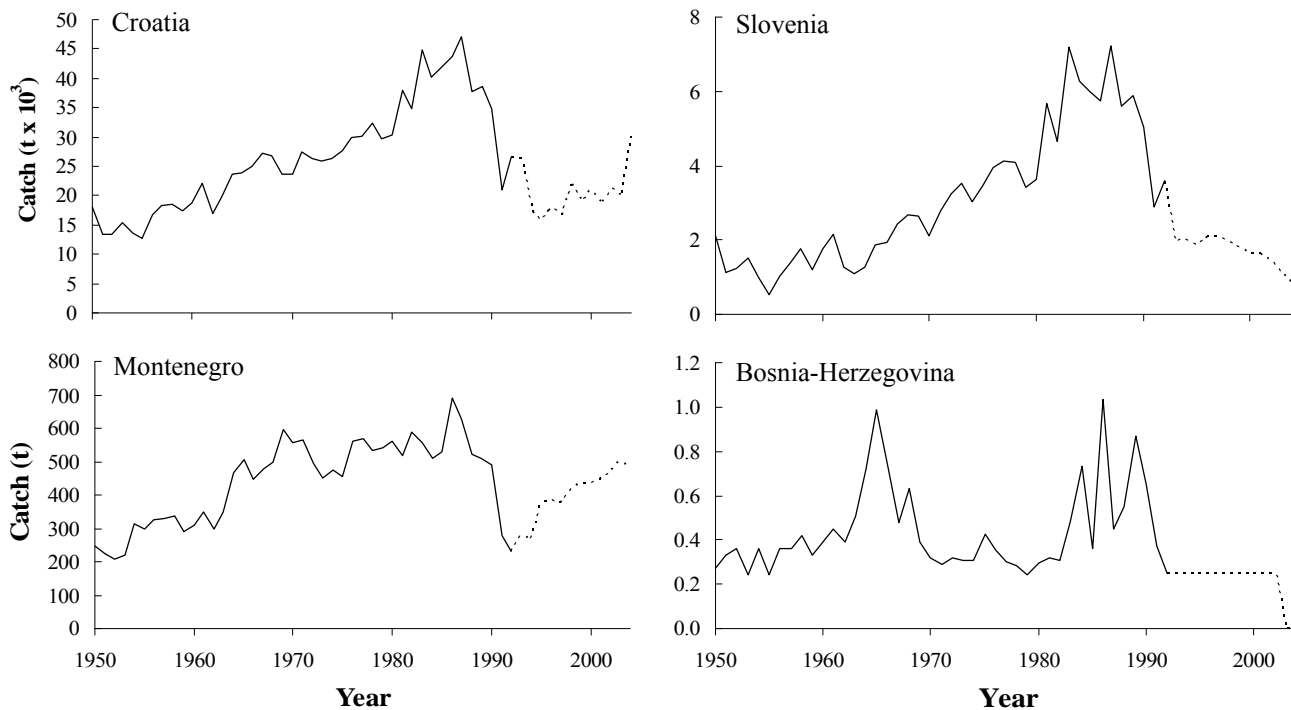
## RESULTS AND DISCUSSION

Overall, marine catches of the former republics of Yugoslavia declined substantially during and after the breakup of Yugoslavia (Figure 2). Catches appear to have stabilized at lower levels for at least two (Croatia and Montenegro) of the four now independent countries (Figure 3). By assuming proportionality of catches (based on the average of the first five years of separate reporting) between the post- and pre-breakup period, we were able to derive the likely distribution of the catches formerly reported as ‘Yugoslavia’, but taken by fishers from the constituent republics for the 1950-1991 period (Figure 4). This approach permits improved spatial allocation of catches as undertaken by the *Sea Around Us* project ([www.seaaroundus.org](http://www.seaaroundus.org)).

It is worth noting that, in this disaggregation method, each country is assigned a catch only for those taxa reported by the former Yugoslavia that it still reported after 1991 and for which the country had some catch before 2001. Consequently, 39 taxa were assigned to Croatia, 36 to Montenegro, 17 to Slovenia and only 1 taxon to Bosnia-Herzegovina. For detailed taxonomic catch breakdown, see [www.seaaroundus.org](http://www.seaaroundus.org).

Additional information and background material on the marine fisheries of former Yugoslavia can be found in Curtis (1990), Mannini and Massa (2000), Sinovic (2000), AdriaMed (2002), Dulcic *et al.* (2005b), Brunner and Johnson (2006), and FAO (2006a,b).

<sup>2</sup> For the few taxa with no reported catch in the reference period, we used the catch from 1997-2001 for that taxon. Catches reported only after 2001 were assumed to originate from a new fisheries for the taxa and country in question, and was not used in the allocation.



**Figure 4.** Marine fisheries catch for 1950–2004, disaggregated into the four now independent republics of the former Yugoslavia, for the period of combined data reported as ‘Yugoslavia’ (1950–1991, solid lines) and the subsequent separately reported period (since 1992, dashed lines).

## ACKNOWLEDGEMENTS

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