A charismatic aquatic species revered throughout the Mekong River, the Mekong giant catfish (*Pangasianodon gigas*) is one of the world’s largest freshwater fishes and is considered critically endangered (IUCN Red List, 2003). A range of conservation initiatives for the giant catfish are being carried out, and this article assesses the conservation status of the Mekong giant catfish and evaluates the likely effectiveness of such conservation measures. The synthesis and analysis of detailed data that were collected intermittently since the late 1960s, through the application of mathematical models, seemed to suggest that very low level of targeted fishing could be allowed to provide long-term monitoring of population data, and that public awareness of the species and the wider Mekong ecosystem should be enhanced. Maintaining the overall Mekong ecosystem (flows, physical habitats and connectivity) is however important to ensure the long-term survival of the species in the wild. Although the captive population of the catfish appears to be sustainable, safeguarding the survival of the species should be ensured before this species becomes extinct in the wild. Captive population should also be managed carefully to conserve its genetic diversity, in the event that re-introduction might become necessary. While the wild population carrying capacity appears to be quite low, releases of even low numbers of captive-bred fish could create significant impacts on the wild population. Moreover, considering that escapes of catfish grown in commercial aquaculture could pose significant threat to the wild population, measures should be taken to minimize the occurrence of such escapes.

The Mekong giant catfish (*Pangasianodon gigas*) or MGC is listed as critically endangered in the IUCN Red List as a result of excessive targeted fishery and incidental harvesting over the past twenty years, and to a lesser extent habitat degradation. Given the critical state of the MGC population, conservation and eventual recovery would require a combination of measures such as captive breeding, reduced harvesting, and conservation/restoration of critical habitats. Although a number of conservation initiatives and programs focusing on the MGC had been carried out, an overall conservation and recovery strategy has not been established. Meanwhile, the effectiveness of measures taken so far is largely unknown, and some measures are even believed to be conflicting or detrimental (Sukumasavin, *et al*., 2014).

**Giant Catfish Fishery and Environmental Changes in the Mekong Region**

**Giant catfish fishing**

Historically, the MGC is being captured in targeted fishery in various parts of the Lower Mekong Basin (Fig. 1). Targeted fishery for the species has generally been associated with festivals of spiritual significance. Although occurring only in...
certain locations and making use of specially constructed very
large-mesh nets, such fishery targets the MGC during their
spawning migration through narrow channels at low water
level where MGC becomes prone to harvesting.

Thus, incidental catches of MGC are relatively rare as the
fishery is largely confined to what is known as migratory
‘bottlenecks’. For example, the most regular incidental
catches are taken in just one Dai net in the Tonle Sap River
in Cambodia, at a location where the Dai blocks virtually the
entire cross-section of the river, while low incidental catches
have also been reported from the Khone Falls area. Incidental
catches elsewhere are extremely rare and do not appear to
follow any identifiable pattern. The history of MGC fishing
at various locations in the Mekong River could be gleaned
from Fig. 1. Nevertheless, insufficient information on the
MGC fishing prior to about 1930 has made the analysis of the
pre-1970 data difficult to undertake due to lack of continuity.

Nonetheless, most accounts provide only snapshots of catches
in particular locations, sometimes with vague references to
previous ‘average’ catch levels. Although several reports
mentioned catch declines, such reports do not clearly state
whether these refer to overall, long-term decline or ‘boom
and bust’ cycles in the fishery. As a matter of fact, ‘high’
local catches of about 50 individuals followed by declines
in catch and catch per unit of effort have been reported for
various locations. Such reports however do not indicate
whether catches of such magnitude have ever been sustained
in the long term.

In interpreting the catch data, it is important to consider that
catches are influenced by both fish abundance and fishing
effort, and that catch declines are not necessarily indicative
of population decline. The armed conflict throughout the
region in the 1970s, particularly the Khmer Rouge regime in
Cambodia resulted in the virtual cessation of MGC fishing in
many locations. Fishing that time was considered dangerous
in the Mekong River Basin especially the area that borders
Thailand and Lao PDR, including many traditional fishing
grounds such as the Chiang Khong/Huay Xai and the Nong
Khai/Vientiane areas. In Cambodia, large-scale fishing
became very restricted during the civil war and ceased
during the Khmer Rouge period.

Fishing history at Chiang Khong District, Chiang Rai
Province in Northern Thailand

The targeted fisheries in Chiang Khong District of Northern
Thailand and in neighboring Huay Xai of Lao PDR, is a
particularly important element of MGC exploitation and
assessment. Such fisheries dominated the overall catches
since 1980s providing the most detailed data on the currently
available population. There is however, no clear record when
MGC fishing begun in Chiang Khong District of Chiang
Rai Province in Thailand. Nonetheless, based on interviews
with local fishers, fishing for the MGC has been practiced
for more than 70 years, and fishing period is about one (1)
month from April to May every year when the fish migrate
to their spawning grounds, which is somewhere around the
“Golden Triangle,” the area that overlaps the mountain ranges
of Myanmar, Lao PDR and Thailand. Meanwhile, the catch
statistics for MGC from Chiang Khong/Huay Xai area from
1973 to 1995 were recorded by Borkeo Province of Lao PDR.
In Thailand, the Department of Fisheries (DOF) recorded the
MGC catches since 1983, when its program on the artificial
breeding of the Mekong giant catfish was started.

Based on recorded data from 1973 to 1983, the catches varied
from 1 to 6 heads per year with an average of 3 heads per
year. After 1983, when the DOF Thailand had succeeded
in the artificial spawning of wild-caught MGC from the
Mekong River, catches from 1984 to 2000 increased to an
average of 29 heads per year, with a maximum of 71 heads.
This dramatic increase in MGC catches reflected a massive
increase in fishing effort between 1983 and 1990, fuelled by
the high demand for MGC of DOF Thailand for its captive
breeding program, as well as from the local tourism industry.
This developed as public awareness about the fisheries and
on the captive breeding program had increased, and massive
promotion campaign dwelling on local people’s belief that
eating MGC would lengthen one’s life, had been intensified.
Furthermore, catch rates (CPUE) in the fishery declined to a
minimum in the mid-1990s while the effort also diminished
resulting from both low catch rates and alternative economic
opportunities. Nevertheless, from 2000 to 2003, no MGC
were caught at Chiang Khong District which was attributed
to rapid blasting in the mainstream of the Mekong River for
navigation and construction of a port in Chiang Khong. When
the said construction was completed, 7 heads were caught in
2004, and 4 heads in 2005. However, a conservation campaign
advocated by both local and international NGOs led to reduced fishing in 2005 and 2006, with a near-complete cessation of MGC fishing in 2006 when the NGOs bought the fishing gear from all registered MGC fishers in Thailand and Lao PDR.

**Environmental changes in the Mekong River Basin**

Environmental changes in the Mekong River Basin had been observed to be gradual and considered moderate in magnitude until the very recent past. Land had also gradually become more agricultural and the hydrology showed no marked changes since the start of a systematic recording in 1960, contrary to widespread perceptions that dams cause significant changes in the water flow. Although access to some tributaries and the upper Mekong/Lancang might have been restricted by the dams, the total area potentially lost accounted for only a moderate proportion of the basin. Nonetheless, more dramatic changes may have occurred in the very recent past with the ‘rapid blasting’ and the commissioning of several dams in the upper river, but any effects of these changes on the MGC population have not been visible in the data. Therefore, fishing has been identified as the main driver of the past changes in the population abundance and structure of MGC in the Mekong River Basin.

**Assessment of the Wild Population of Mekong Giant Catfish**

**Population model and parameter estimation**

Length-structured matrix population model was adopted as the main assessment tool for determining the status of the wild population of MGC. The recruited population was divided into length groups, and the model population and catch numbers grouped into length over time. The detailed data collected intermittently since the late 1960s were then synthesized and analyzed with the use of a mathematical model, taking into consideration certain assumptions that underlie the baseline model (Box 1). An overview of the model parameters and their baseline values is shown in Table 1.

### Box 1. Assumptions on the parameters considered for the baseline population model

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Means of verification</th>
</tr>
</thead>
<tbody>
<tr>
<td>MGC in the Mekong Basin form a single population</td>
<td>All catches have been taken from the same population</td>
</tr>
<tr>
<td>Full population is vulnerable to fishing</td>
<td>No reports on un-fished and unobserved local populations</td>
</tr>
<tr>
<td>Reporting of MGC catches is near-complete and not size-biased</td>
<td>There is no unreported harvest of small MGC</td>
</tr>
</tbody>
</table>

**Assessment of the population status of MGC: Model Fitting**

Most of the parameters used for model fitting were estimated from the subsets of data or comparative information shown in Table 1, but only the level of recruitment $R_e$ in the unexploited population $B_0$ and the catchability coefficient $c$ (a constant proportionally relating CPUE to the absolute abundance) were estimated by fitting the model into a time series for fisheries data. The data set used for model fitting was the CPUE time series for the Chiang Khong/Huai Xai fisheries. Fitting the model to CPUE data started with equilibrium solutions for a variety of plausible exploitation scenarios during 1960s-70s and levels of recruitment compensation running forward through 1973-2005. In each year, the model population was reduced by the actual (reconstructed) catches and the action of natural mortality but new recruits were also gained based on the stock-recruitment relationship. Recruitment of the unexploited population $R_e$ and the catchability coefficient $c$ were then estimated by numerically searching for values that provide the best fit to the CPUE data. As previously highlighted, key uncertainties in population assessment include the level of natural mortality such as exploitation rate prior to the Chiang Khong fishing boom, and the level of recruitment compensation. A variety of scenarios, i.e. E1970s and K, allowed acceptable model fits based on the available catch and CPUE data (Table 2). However, there is no strong basis for discriminating among the fits those that

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L_c$</td>
<td>Asymptotic length</td>
<td>290 cm</td>
</tr>
<tr>
<td>$a$</td>
<td>Coefficient of l-w</td>
<td>0.12</td>
</tr>
<tr>
<td>$b$</td>
<td>Exponent of l-w relationship</td>
<td>2.8</td>
</tr>
<tr>
<td>$L_m$</td>
<td>Reference length</td>
<td>200 cm</td>
</tr>
<tr>
<td>$M_0$</td>
<td>Natural mortality rate at $L_m$</td>
<td>0.15 year$^{-1}$</td>
</tr>
<tr>
<td>$R_0$</td>
<td>Recruitment at $B_0$</td>
<td>345</td>
</tr>
<tr>
<td>$F$</td>
<td>Fishing mortality rate in fully exploited size groups</td>
<td>Variable</td>
</tr>
<tr>
<td>$L_r$</td>
<td>Gear selection length</td>
<td>224 cm</td>
</tr>
<tr>
<td>$q$</td>
<td>Steepness of selectivity curve</td>
<td>-0.1</td>
</tr>
<tr>
<td>$c$</td>
<td>Catchability coefficient</td>
<td>0.00417 boat$^{-1}$</td>
</tr>
</tbody>
</table>

Source: Adapted from Sukumasavin, et al. (2014)
were associated with these alternative scenarios. As a result, all acceptable model fits predicted a spawner abundance of about 250 heads which could have been possible at the start of the Chiang Khong ‘fishing boom’. At any rate, the estimates of unexploited spawner abundance vary from 355 to 2,200 heads (Table 2). Hence, the abundance at the start of the Chiang Khong ‘fishing boom’ represented between 11% and 71% of the unexploited abundance. Furthermore, natural mortality rate $M_r = 0.12 \text{ year}^{-1}$ at $L_r = 250 \text{ cm}$ which was used as baseline (grey column in Table 2), while some predictions were made for $M_r = 0.06 \text{ year}^{-1}$ at $L_r = 250 \text{ cm}$ (blue column in Table 2). The results indicated that the models provide a good overall fit to the observed CPUE time series as shown in Fig. 2. The models which provided very similar CPUE and abundance estimates for much of the period but diverged somewhat towards the end, thus predicted the same abundance prior to the Chiang Khong ‘fishing boom’ of about 250 spawners and similar pattern of reduction during the ‘fishing boom’ but differ in the predicted recovery pattern. The model also reproduced the catch length distribution in 1999-2005 as shown in Fig. 3.

**Reconstructed Population and Fishing History**

The reconstructed spawner abundance (Fig. 4) shows a relatively stable spawner population of about 250 heads prior to 1983 (11-71% of unexploited abundance). The population then declined dramatically to just 50 spawners in 1995 (2-14% of unexploited abundance).

The Chiang Khong ‘fishing boom’ therefore led to the reduction of spawner abundance by about 80% in just ten years, although the model also predicted that the population has since recovered significantly. The predicted current (2006) level of spawner abundance is estimated at 145 heads or 7-40% of the unexploited abundance.

**Table 2.** Equilibrium catch, unexploited spawner population ($N_0$) and relative spawner population prior to the Chiang Khong fishing boom (Rel N) estimated for different combinations of exploitation rate in the 1970s and recruitment compensation $K$. Combinations marked in red lead to predictions that are inconsistent with the available data. The scenarios used in predictions are highlighted in grey ($M_r = 0.12 \text{ year}^{-1}$) and in blue ($M_r = 0.06 \text{ year}^{-1}$)

<table>
<thead>
<tr>
<th>$M_r$ at $L_r = 250 \text{ cm}$</th>
<th>0.04</th>
<th>0.06</th>
<th>0.08</th>
<th>0.10</th>
<th>0.12</th>
<th>0.14</th>
<th>0.16</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E$ (1970s)</td>
<td>0.8</td>
<td>0.7</td>
<td>0.6</td>
<td>0.5</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$K=100$</th>
<th>Catch</th>
<th>27</th>
<th>29</th>
<th>24</th>
<th>20</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>$N_0$</td>
<td>860</td>
<td>622</td>
<td>501</td>
<td>414</td>
<td>355</td>
<td></td>
</tr>
<tr>
<td>Rel N</td>
<td>0.294186</td>
<td>0.406752</td>
<td>0.50499</td>
<td>0.611111</td>
<td>0.712676</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$K=5$</th>
<th>Catch</th>
<th>23</th>
<th>29</th>
<th>24</th>
<th>20</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>$N_0$</td>
<td>2200</td>
<td>1149</td>
<td>694</td>
<td>490</td>
<td>404</td>
<td></td>
</tr>
<tr>
<td>Rel N</td>
<td>0.114948</td>
<td>0.220191</td>
<td>0.364553</td>
<td>0.516327</td>
<td>0.626238</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$K=2$</th>
<th>Catch</th>
<th>-</th>
<th>-</th>
<th>-</th>
<th>20</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>$N_0$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1480</td>
<td>745</td>
<td></td>
</tr>
<tr>
<td>Rel N</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.170946</td>
<td>0.339597</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 5. Spawner population abundance predicted by the population model assuming normal recruitment or complete reproductive failure since 1990, predictions for $M_r = 0.12$ year\(^{-1}\) depend on reproduction during and after the period of very low spawner abundance. Unless recruitment compensation is extremely high ($K=100$, Fig. 4), spawner abundance is predicted to decline again between 2010 and 2020 as a result of low spawner abundance and reproduction output during the 1990s. However, even if reproduction failed entirely from 1990 onwards (e.g. as a result of the Allee effects or due to environmental factors), the effect would only become apparent after 2010 (Fig. 5). This implies that the basic life history of MGC should be taken into consideration when interpreting catch and abundance trends, and that long-term monitoring would be necessary. The model-based population reconstruction had also provided direct estimates of fishing mortality rates, where the fishing mortality pattern for $M_r = 0.12$ year\(^{-1}\) clearly shows a dramatic increase in fishing pressure on the mature population between 1983 and the early 1990s (Fig. 6). Fishing mortality rates then declined and returned to pre-1983 levels by 2004. Instantaneous fishing mortality rates $F$ can be translated into proportional harvest rates $H$, i.e. proportion of the available population harvested in the fishery. Thus, the pre-1983 and post-2004 fisheries had removed about 10% of the population per year, and in 1990-2000, over 50% of the available population was harvested annually at a maximum rate of 96% in 1995.

**Potentials for Sustainable Exploitation**

In assessing the potentials for sustainable exploitation of the MGC, the equilibrium (=sustainable) catch and the corresponding spawner abundance of the population were calculated, given different levels of natural mortality and recruitment compensation as shown in Fig. 7.

The level of natural mortality and pre-boom exploitation assumed major implications for the assessment of the
‘traditional’ (pre-boom) level of fishing. For $M_r = 0.12 \text{ year}^{-1}$ at $l_r = 250 \text{ cm}$ (E1970s=0.4), traditional fishing conducted at or below the effort level provided the maximum sustainable catch. For $M_r = 0.06 \text{ year}^{-1}$ at $l_r = 250 \text{ cm}$ (E1970s=0.7), traditional fishery overexploits the population if $K=5$, and represents a very high level of exploitation if $K=100$, although it is not possible at present to discriminate between these scenarios, as the true level of natural mortality and pre-boom exploitation is unknown. Such a situation however does not present a major problem for management in the short-to-medium term because the population is currently depleted and unlikely to rebound to levels at which the maximum sustainable catch could be attained, even for the next at least 2-3 decades. Nonetheless, the different models have very similar implications for population management in the medium term.

**Release of captive-bred fish**

Captive-bred MGC could be released to raise recruitment to the level estimated for the unexploited population, thereby speeding up recovery without exceeding the estimated carrying capacity for recruits. If ‘traditional’ levels of fishing are maintained and captive-bred fish are released from 2010 onwards at a level commensurate with the natural carrying capacity, this would raise the abundance of spawner population starting from about 2025 onwards but only with medium-low recruitment compensation (Fig. 8). Nonetheless, in all cases except for very low recruitment compensation ($K=2$), complete cessation of MGC fishing would lead to faster recovery than releasing captive-bred fish.

**Implications of possible exploitation of small juveniles**

Exploitation of MGC juveniles less than 100 cm in length has remained unknown. However, any exploitation occurring at this stage would affect recruitment to the population of large MGC (>100 cm in length) that are exploited by known fishery. Thus, it is also necessary to model the effect of juvenile exploitation by introducing a juvenile harvest rate $H_j$ into the stock-recruitment function, i.e. $\text{Recruitment of large juveniles} = \text{recruitment of small juveniles} \times (1-\text{juvenile harvest rate } H_j)$. The juvenile harvest rate $H_j$ acts simply as a scaling factor to recruitment and does not affect the analysis of the population dynamics as long as $H$ remains constant. Baseline analysis estimated that the level of maximum recruitment of about 345 fish (100 cm in length) corresponds to that of the Chiang Khong ‘fishing boom’ and the level of recruitment in the 1970s. If this recruitment level had been influenced by juvenile harvesting at the rate of $H_j$ (1970s), then the natural recruitment level in the absence of juvenile harvesting would be higher by $1/(1-H_j)$. Likewise the spawner population abundance and sustainable yield in the absence of juvenile fishing would be proportionately higher as shown in Fig. 9.

**Future Population Change**

From the abovementioned results, the future population trends have been predicted for several different scenarios, especially with respect to fishing, releases of captive-bred fish, and reproductive failure.

**Fishing**

Predictions had been given for ‘traditional’ level of fishing mortality and a scenario where all fishing for MGC is stopped from 2007. Although ‘traditional’ fishing scenario is deemed most likely in the medium term, closure of the Chiang Khong/Huay Xai fisheries and decommissioning of the Dai net fisheries responsible for the bulk of MGC catches in the Tonle Sap River would lead to a ‘no fishing’ scenario.

Nevertheless, since the MGC population is expected to recover under both scenarios (Fig. 10), recovery would be faster towards a higher level of abundance if fishing were discontinued. For recruitment compensation $K=5$, the population would recover to pre-1983 abundance around 2025 in the absence of fishing, but would still be below the pre-1983 abundance in 2050 if fishing is continued at the ‘traditional’ level.
Recruitment failure
Recruitment failure could be a result of destruction of spawning and juvenile habitats or from depensatory (Allee) effect at low spawner abundance. However, the effects of recruitment failure could be visible only after some 15-20 years since its first occurrence (Fig. 5).

Role of captive-bred and culture fish
Captive-bred and cultured fish could play an important role in future population change, whether the fish comes from deliberate releases or accidental escape from aquaculture facilities. While examining the impacts of captive releases on the recovery of spawner population, the survival and growth parameters for MGC released into semi-natural environments or reservoirs could also be estimated although the impacts of such releases on the wild population should be taken into consideration.

Potential effects of releases on wild population
In assessing the impacts of deliberate or accidental releases of cultured fish on the wild population, the fisheries enhancement model of Lorenzen (2005) in the EnhanceFish package could be used, with the assumption that captive-bred and cultured fish show the same growth and mortality patterns as wild fish, as well as in terms of reproductive competence. Using such package, the impacts of releasing large ‘recruits’ (100 cm in length) as shown in Fig. 11 indicate that although releases are predicted to increase the total fisheries yield and population biomass, the wild population component could be depressed. Even if a moderate release of about 300 recruits would result in a significant wild population impact as a result of the estimation, the wild population carrying capacity would be very low combined with the wild-like fitness of released fish.

In the deliberate releases of MGC, smaller fish of about 10-20 cm in length could be used but such fish could undergo relatively high and most likely, density-dependent mortality before even reaching the 100 cm length. Releases of few hundreds or even thousands of 20 cm fish per year would also have little impact on the total yield while moderately depressing the wild population biomass (Fig. 12). Thus limited, e.g. ceremonial releases of small captive-bred MGC could still be conducted without posing a major threat to the wild population.
Implications for Conservation Strategy Development

Threat assessment
The factors that threaten the survival of MGC could include fishing, habitat degradation, and interactions with culture-bred fish. However, the known fishery targeting large MGC appears to be less of a threat to population persistence than previously thought. The highly size-selective nature of the fishery and low level of incidental harvesting imply that the population is quite resilient to overfishing. Thus, a moderate level of traditional fishing could still be allowed without compromising population viability. This could have an overall beneficial effect in terms of providing long-term monitoring data and maintaining public interest in the species.

Nevertheless, such effort should ensure that fishing intensity remains well below the levels seen at the height of the Chiang Khong fisheries, and that there is no increase in incidental catches (e.g. due to new gear development). Furthermore, the current assessment of sustainable catch levels may be revised should population dynamics be affected by other threats. Since the extent to which small juveniles of less than 100 cm length are subjected to exploitation remains unknown, and if there is significant exploitation at this stage, this could have a strong effect on population abundance. Such exploitation would however be entirely incidental, i.e. MGC are neither targeted nor indeed known to be caught by gill net fisheries exploiting this size range, although this is very difficult to address without placing strong restrictions on the mainstay of Mekong fisheries.

The latter of course is not a realistic proposition and therefore possible exploitation of juvenile MGC is in effect an external factor. Habitat degradation is unlikely to have played a major role in past population change, but may play a larger role in the future as population growth and economic development lead to increased utilization of the Mekong River Basin and its associated natural resources. The most important known threats are likely to be navigational improvements and hydrological change in the spawning grounds, and loss of access to juvenile habitats due to the damming of Mekong tributaries. Modification of spawning habitats may be the most acute threat, and would be detectable in the adult population only about 20 years after any impact.

While loss of access to juvenile habitats could result in reduction of carrying capacity, the small population size and low carrying capacity of the MGC make the population vulnerable to ecological and genetic interactions with released cultured fish. Nonetheless, as noted in many fora, there has been little ‘hard’ information on the effectiveness of any of the conservation measures. The quantitative assessment in Box 2 could provide new insights with important implications for the prioritization of conservation measures.

Conclusion and Recommendations

Results of the reconstructed spawner abundance indicated a dramatic decline of MGC spawners to just 50 in 1995 but recovered to about 145 heads by 2006. Fishing had affected the abundance and structure of the MGC population, specifically contributing to the depletion of the MGC stock. However, very low levels of harvest (up to 10 mature fish basinwide) could still be allowed until 2030 for the population to recover from its current state, and also for long-term population monitoring of population data. Recent changes in the environment of the Mekong River Basin have not affected the population abundance of MGC but it is still necessary to maintain the overall Mekong ecosystem, i.e. water flows, physical habitats and connectivity, to ensure long-term survival of the species in the wild. Considering that habitut use and migration patterns of the species are largely unknown, the essential habitats of MGC could not be established except for the spawning area, which is most likely some 50 miles north of Chiang Khong District in Chiang Rai Province of Thailand. It is therefore an immediate priority that this habitat should be protected.
The efforts of the Department of Fisheries (DOF) of Thailand to maintain captive population would provide vital ‘insurance’ for safeguarding the survival of the species should it become extinct in the wild. However, such captive population should be managed carefully so as to conserve genetic diversity, should re-introduction become necessary. For the time being, captive-bred fish should not (even only in very low numbers) be released into the Mekong River or its tributaries because the wild population is likely to recover naturally. Although interaction with cultured fish might not have played a significant role in past population change, this might be a major issue in the future in view of both intentional and accidental releases, especially that the present cultured population is likely to exceed the wild population in terms of abundance. Nevertheless, escapes of MGC from commercial aquaculture operations could pose a significant threat to the wild population. Measures should therefore be taken to minimize the occurrence of such escapes for although the wild population carrying capacity appears to be quite low, releases of even low numbers of captive-bred fish could have significant impacts on the wild population.

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**About the Authors**

Dr. Naruepon Sukumasavin is from the Office of Experts, Department of Fisheries, Bangkok, Thailand.

Mr. K. Lorenzen is with the Program in Fisheries and Aquatic Sciences, School of Forest Resources and Conservation, University of Florida, 7922 NW 71st St., Gainesville, Florida, FL 32653 USA.

Mr. Z. Hogan is with the Center for Limnology, University of Wisconsin-Madison 680 N. Park Street, Madison, Wisconsin, WI 53706 USA.